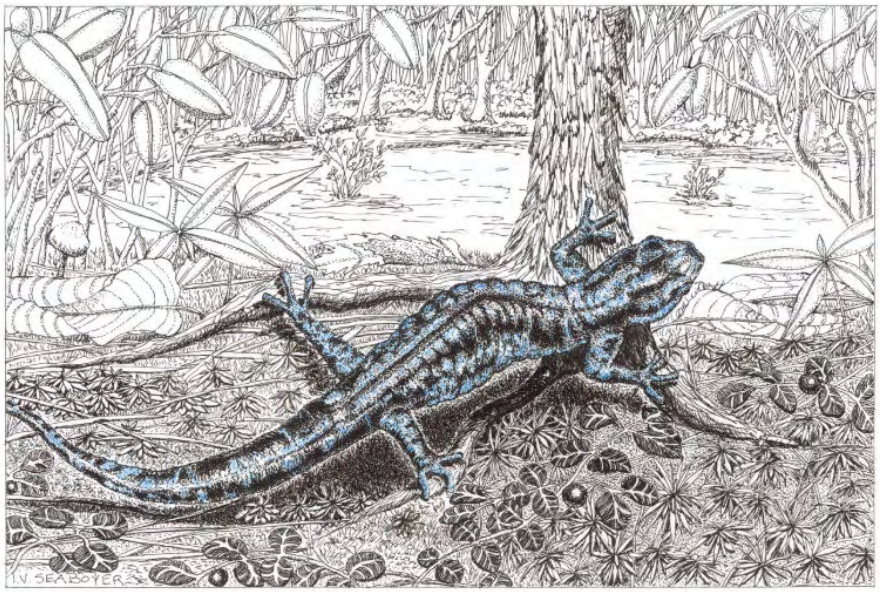
9-2008

Danville Town Forest Stewardship Plan

Ellen Snyder
Ibis Wildlife Consulting

Danville Town Forest

Stewardship Plan



Prepared for the
Town of Danville

Prepared by
Ellen Snyder
Ibis Wildlife Consulting
Newmarket, New Hampshire

This project was supported by the New Hampshire Estuaries Project with funding from the New Hampshire Charitable Foundation – Piscataqua Region.

NewHampshire EstuariesProject

Preface

This Stewardship Plan for the Danville Town Forest was prepared through a collaborative process among the following organizations and town committees:

Danville Board of Selectmen
Danville Conservation Commission
Danville Forestry Committee
Danville Heritage Commission
Ibis Wildlife Consulting
New Hampshire Audubon
New Hampshire Estuaries Project

This group held several meetings at the Danville Town Hall to discuss the scope of work (April 2, 2008), to review draft Chapters 1 and 2 (June 26th), and to review draft Chapters 3 and 4 (August 21st). Several public meetings were held to gather input on the draft chapters and stewardship goals and issues. These public sessions were held on July 24th, July 27th (site walk), and September 18th. All the meetings and site walks were open to the public. In addition, all the town hall meetings were broadcast on local access television and documents were made available on a town website.

Cover drawing of a blue-spotted salamander by Inge Seaboyer used by permission.

Danville Town Forest
Stewardship Plan

Table of Contents

Chapter 1 Introduction

Purpose of the Stewardship Plan

As a community resource the Town Forest offers many benefits and values to residents and visitors. The Forest provides wildlife habitat, scenic beauty, clean air, cool temperatures, hiking trails and other outdoor recreation, wood products, water supply protection, flood storage, historical artifacts, among others. People value the Town Forest for many different reasons. Fortunately, most of these are complementary benefits, each available without compromising the integrity of the others.

A goal of this Stewardship Plan is to understand and appreciate the values of the Town Forest and to guide the use and management of these resources over time. This is achieved by identifying the known soils, topography, plants, animals, habitats, forests, waterways, historical artifacts, and public uses that occur in the Town Forest. The surrounding landscape, including ownership patterns, affects the Town Forest, and therefore can influence stewardship decisions. Past, present, and potential future natural and human disturbances are also an important factor in guiding long-term stewardship. The Stewardship Plan builds an understanding of the relationship among these features and factors.

Another purpose of the Stewardship Plan is to meet the provisions of a proposed conservation easement on the Town Forest. The Town of Danville is working with New Hampshire Audubon to convey an easement on a majority of the Town Forest to that organization. The draft conservation easement deed requires that all activities in the Town Forest be conducted in accordance with a Stewardship Plan. The specifics of the conservation easement deed are described in more detail below (see page 8-9) and a copy of the draft easement deed is in Appendix A.

A grant from the New Hampshire Estuaries Project (NHEP) Community Technical Assistance Program provided funding to complete this Stewardship Plan. NHEP contracted with Ibis Wildlife Consulting to prepare the Plan, working with the Danville Forestry Committee, Conservation Commission, Heritage Commission and Selectmen, as well as staff from the NHEP and New Hampshire Audubon (Audubon).

Many people through participation in the abovementioned committees contributed information and ideas to the Plan. Existing plans, studies and other documents provided valuable information about the Town Forest.

Location

The 420+acre Danville Town Forest is located in the northwest section of Danville, just to the north of the center of town. Most of the Town Forest lies to the west of Route 111A (Main Street); a disjunct 20-acre portion lies to the east of Rte 111A with access off Happy Hollow Road (Map 1). The Town Forest has approximately 2,583 feet of frontage along Rte 111A, a major north-south road through Danville. A small dirt parking lot is accessible off Rte 111A, about 1,000 feet south of Tuckertown Road. The parking lot hosts a kiosk and provides access to a trail network. Tuckertown Road is a gated class A trail and designated scenic road that bisects the Town Forest, extending from Rte 111A west to the Town of Sandown (see Appendix E for definitions). A Public Service of New Hampshire (PSNH) utility easement runs northwest/southeast through the western section of the Town Forest.

Town Forest Boundaries

The Danville Town Forest comprises more than a dozen different lots of record, some acquired through tax deeds. Old tax deeds are often thin in their legal descriptions, which can lead to confusion about the precise boundaries of a parcel. In anticipation of conveying a conservation easement on the Town Forest, the Town hired Doucet Survey, Inc. of Newmarket, New Hampshire to complete the deed research and survey the entire boundary. Doucet completed the survey on March 12, 2006; the Town recorded the survey at the Rockingham County Registry of Deeds on October 27, 2006 as Plan D-34246. A copy of this survey is included in Appendix B. The Doucet survey was used by Ibis Wildlife Consulting to create the boundary for the Stewardship Plan maps.

History of the Town Forest

New Hampshire statute gives towns and cities the ability to establish a Town Forest with a main purpose "to encourage the proper management of timber, firewood and other natural resources through planting, timber stand improvement, thinning, harvesting, reforestation, and other multiple use programs consistent with the forest management program, any deed restrictions and any pertinent local ordinances or regulations (RSA 31:111).

In 2000, the Danville Board of Selectmen appointed a Forestry Committee of three members as authorized in RSA 31:110-112 to oversee the management of the town forest. In 2001, residents voted to officially designate over 400 acres of land as Town Forest and to establish a Town Forest Maintenance Fund.

In 2002, the Forestry Committee hired Charles Moreno, a licensed consulting forester, to prepare a Forest Management Plan (FMP) for the Danville Town Forest. The FMP contains important information about the forest types, wetlands, and other features of the Town Forest.

One outcome of the forest management planning process was to re-affirm the protection of wildlife habitat, particularly the extensive wetlands, as a high priority in the Town Forest. In 2003, the Town voted to convey a conservation easement on the Town Forest to a conservation organization, to ensure the permanent protection of the Town Forest as open space to be managed for multiple conservation benefits, including wildlife habitat, watershed protection, recreation, timber production, scenery, and natural area preservation.

The Town decided to work with New Hampshire Audubon on the conservation easement, given that organization's dedication to the conservation of wildlife and habitat throughout the state. The Conservation Commission also gathered feedback from the NH Fish and Game Department on ways to inventory and protect wildlife and their habitats in the Town Forest, particularly in light of the recently completed NH Wildlife Action Plan.

The Town Forest Lots

In 1951, the Town voted to designate two parcels of land as "Town Forest." Only one of those, the "Peaslee" lot remains as part of the Town Forest. The history of the Danville Town Forest begins as early as 1700, when Danville was within the original boundaries of the Town of Kingston. In 1694, Kingston separated from Hampton, taking a portion of what was later to become Kingston, East Kingston, Danville, Sandown, and parts of Hampstead.

At a town meeting of the Kingston Proprietors on December 19, 1700 and on October 31, 1706 grants of 200 acres on the westerly side of town were given to various grantees. These 200-acre grants were 34 rods wide and three miles long. The western boundary went as far as Angle Pond (now Sandown); the northern boundary was Exeter (now Fremont) and the southern boundary Hampstead. The eastern boundary was essentially what is now Route 111A. When the boundary line was finally settled between Sandown and Danville, each town ended up with about one-half of the original 200-acre grants (34 rods wide by 1.5 miles long). Sandown became a separate parish in 1756 and Danville in 1760. At that time, Danville was known as the Parish of Hawke.

For each lot, the four corner boundary trees were marked on all four sides with the lot number. The Danville Town Forest of today (except for the portion that is east of Route 111A) lies in parts of the 10th, 11th, 12th, 13th, 14th, 15th, and 16th lots as they were originally laid out in 1700 and 1706. Old deeds often refer to a parcel of land, for example, as "being part of the 12th lot in the 200 acre grants, so called…". The sequential lot numbers began at the Fremont line as No. 1 through No. 45. Tuckertown Road lies between the 13th and 14th lots. It was laid out by the selectmen in 1766.

The two oldest Town Forest parcels are called the "parsonage" lands. They were acquired by deed in 1761 by the Parish of Hawke. The 55-acre parsonage parcel lies in part of the 12th lot in the division of the 200-acre grants. The 20-acre parsonage parcel is the disjunct parcel south of Happy Hollow Road. From 1790 to 1991 the parsonage land and Parsonage Fund were managed by a three person elected Parsonage Committee to carry out the intention of the deeds of 1761 that read "for the use of the Ministry forever." The Parsonage Fund is no longer used for Ministry, but for the maintenance and preservation of the Meeting House, which is across the road from the Town Forest.

As in many towns, some of the current parcels within the Town Forest came through tax collector deeds, the land forfeited by the landowner. Table 1 shows the year and the reason for each of the parcels becoming part of the Town Forest, as well as the purpose of any income derived from each parcel.

Table 1. History of acquisition of each parcel within the Danville Town Forest

Tax Map & Lot #	Former Owner	How	Year	Income
1-54/57	Parsonage land	Land swap	1761	Parsonage Fund
2-57	Parsonage land	Land swap	1761	Parsonage Fund
1-49	Mills & Heath	Tax deed	1933	Forest Fund
1-52	Peaslee land	Tax deed	1933	Forest Fund
1-53	Mary J. Sanborn	By will	1938	Churches
1-63	Mary J. Sanborn	By will	1938	North Library
1-60	Brown land	Tax deed	1941	Forest Fund
1-56	George land	Tax deed	1954	Forest Fund
1-68/69	West land	Tax deed	1954	Forest Fund
1-62	Great Meadow	Fee purchase	1999	Forest Fund

History of Land Use in the Town Forest

By the mid-1800s, nearly 75 percent of central New England had been cleared for agriculture. Small woodlots remained intermingled with crops and pastures, as they were an important source of fuel for farmers. Whether farmed or logged, much of the landscape in southern New Hampshire, including Danville, was impacted by these landscape-scale changes. As farms in the region were abandoned in the late 1800s, for a better or different life elsewhere, the forests began to grow back, and by the 1970s New Hampshire was becoming mostly forested once again.

The ownership history and current condition of the Danville Town Forest reflects a similar pattern of land use over the past several hundred years. Records from the Parsonage indicate timber sales and farming dating back to the early 1800s. The last owner of the "Peaslee" lot was a lumber company, Mills & Heath, which abandoned the lot in the 1930s after it was cut over. The Town took possession of the parcel for unpaid taxes in 1933. A detailed forest type map of the two parsonage lands was drawn by the NH Forestry Department in December 1938 after the hurricane took many trees. In 1941 the hurricane lumber was sold and the proceeds were used to reforest. The first Town Forester on record was Dana Lessard. Melton Sanborn was the Town Forester from 1971 until his death in 1998. The Town of Danville Annual Reports include records of income from wood cut in the Town Forest.

Tuckertown Road

In 1953 Tuckertown Road (also known as Tucker Road) was closed by vote of Town Meeting. In 1973, Danville residents voted to designate Tuckertown Road as a *scenic road* under the provisions of RSA 253:17,18 and that the road shall remain closed and in an unimproved (unpaved) surface condition to protect the scenic and historic character of the road. Tuckertown Road was further designated a class A trail in 1993. A gate was erected at the entrance off Rte 111A in 2004 to control access on the road. Tuckertown Road is used for recreation, including walking, nature observation, bicycling, motorized recreation, and snowshoeing (Map 2). It is an easy one+ mile walk from one end to other, although beavers have flooded the trail in the mid-section.

Danville Historic District

The purpose of the Danville Historic District is to safeguard the heritage of Danville by protecting historic structures and architectural history, foster appreciation of the town's beauty and history, protect the town's character and rural setting, and promote use of historic structures.

Through the efforts of the Danville Heritage Commission, a Historic District Ordinance was proposed and approved as a warrant article in March 1999 to provide for future protection of Tuckertown Road, town owned property north and south of the road, and the Old Meeting House and cemetery, and Ye Olde Cemetery." A copy of the Danville Historic District Overlay and Historic District Ordinance is in Appendix C.

A portion of the Town Forest is within the Historic District. While at this time there is no known historic building foundations in the Town Forest, there are several stonewalls within or along the boundaries of the Town Forest, a testament to past land use (Map 2). To date there have been no professional or formal historic investigations, studies, surveys, or mapping regarding the parcels of land that comprise the Danville Town Forest.

The historic Hawke Meetinghouse is located directly across the road from the Town Forest and entrance to Tuckertown Road. The building is on the National Registry of Historic Places and is recognized as the oldest original construction meeting-house in New Hampshire. Just up the road on the opposite side is the "Ye Olde Cemetery," adjacent to the Town Forest Parsonage land.

Surrounding Land Use and Ownership Patterns

The Danville Town Forest is bounded by Rt 111A along its eastern boundary. Residential subdivisions and the Colby Pond Recreation Area border the southern boundary; some of the houses abut the Great Meadow wetland. A large portion of the western boundary has a large, proposed subdivision that is pending approval. Another landowner, who is pursuing sand and gravel extraction, abuts the northwest corner of the Town Forest. The northern boundary of the Town Forest abuts large, forested private ownerships. The 45-acre Phyllis Massey Stafford Conservation Area is surrounded by Town Forest on three sides with frontage on Tuckertown Road and Rte 111A (Map 3). The Society for the Protection of New Hampshire Forests holds a conservation easement on the Stafford Conservation Area. The 20-acre parcel south of Happy Hollow Road is bordered on the west by privately owned forested parcels. The 60-acre ownership along the eastern boundary of the 20-acre Town Forest parcel off Happy Hollow Road (commonly known as the Parsonage Land) was heavily cut 5-6 years ago. A residential subdivision abuts the parcel to the south.

Public Service of New Hampshire Easement

In 1974, the Town of Danville granted an easement to Public Service of New Hampshire (PSNH) to maintain their utility line within a 280-foot wide corridor (see Rockingham County Registry of Deeds Book 2231 Page 1227). The easement allows PSNH to maintain the lines and associated structures and to manage the vegetation within the corridor. This linear feature through the Town Forest is used by off-highway recreational vehicles and supports a unique habitat not found elsewhere in the Town Forest.

Proposed Conservation Easement

Danville residents approved the placement of a conservation easement on the Town Forest by a warrant article in March 2003. The final easement deed is nearing completion with the combined efforts of the Conservation Commission, Forestry Committee, Heritage Commission and the Board of Selectmen (See Appendix A for a copy of the draft Easement Deed for the Town Forest). The conservation easement is proposed for all of the Town Forest, except the PSNH utility corridor and Tuckertown Road, which will be excluded from the conservation easement.

Conservation Easements
A landowner has a bundle of rights to use and modify the property that they own. A conservation easement is a legal agreement between the landowner and a conservation organization, agency, or municipality that transfers some of these rights (typically the “development rights”) to the organization that holds the easement. Typically a conservation easement is granted in perpetuity and therefore the development rights are extinguished forever, preserving the land as open space. Each easement deed is crafted to fit the features of the property to be protected, the needs of the landowners, and the goals of the entity accepting the easement. Easements are used to provide permanent protection from subdivision or other development or uses that could degrade or destroy ecological, scenic, or other natural resources. Easements often provide for continued farming, forestry, wildlife management, and recreation. A landowner who conveys a conservation easement is the grantor and the recipient organization is the grantee.

The proposed conservation easement for the Danville Town Forest will protect the land in its entirety and in perpetuity as open space, preventing any residential and industrial development, commercial activities, and mining. Forestry and agriculture are allowed as well as wildlife habitat management, outdoor education, and outdoor recreation.

The Purposes of the draft conservation easement are to:

- conserve and manage wildlife habitats, wetlands and water resources, and ecological processes
- provide public access for low-impact outdoor recreation and education
- preserve and conserve cultural and historic resources
- provide for agricultural use of the soils of agricultural significance if desired
- retain in perpetuity for sustainable forestry
- retain the scenic quality

The draft easement deed details the stewardship goals for the Town Forest related to biological diversity and integrity, unique historic archeological and cultural features, outdoor recreation and education, sustainable source of forest products, forest health, soil productivity, native species and non-native invasive species, water quality protection, and conservation of wetlands, riparian areas and aquatic habitats.

Chapter 2 Ecological Setting and Existing Features

Introduction

The Danville Town Forest lies within what is known as the Gulf of Maine Coastal Plain, an area of transitional forest or "tension zone" between the boreal forest to the north and hardwood forests to the south. New Hampshire's Wildlife Action Plan places the Town Forest in a region of two broad forest types: Appalachian-Oak Forest and Hemlock-Hardwood-Pine Forest.[1] Within these broad "matrix forest" habitats are patches of other habitats including wetlands, streams, and other water bodies. Soils, topography, aspect, and disturbance patterns determine the dominant tree species and other plants that grow on a specific site.

The forested landscape in Danville and elsewhere in southeastern New Hampshire has experienced a variety of disturbance histories. Natural disturbances of these forests largely come from single-tree windthrow, with occasional larger blowdowns from hurricanes.[2] Beaver are also an important natural disturbance dynamic, particularly in the Town Forest with the extensive network of wetland systems. These forests have evolved for thousands of years with these natural disturbances. More "recent" disturbances include farming and farm abandonment, human settlements, logging, recreation, and introduced forest pathogens. A new, and perhaps more insidious disturbance, involves climate change, that has yet to fully express itself in changes to forest and wetland ecosystems in this region.

The current condition of the Danville Town Forest is an expression of the inherent site capability as well as past and present natural and human disturbances. This is a snapshot in time. Natural plant succession along with disturbance will continue to create change in the Town Forest.

Numerous sources of information were used to understand and describe the ecological setting and natural features of the Danville Town Forest. These sources included the following studies, surveys, and plans:

- Town of Danville, NH Natural Resources Inventory (1998)
- Forest Management Plan for the Danville Town Forest (2002)
- Wetland Inventory: Danville, New Hampshire (2002)
- Danville Town Reports and Ordinances
- Doucet Survey, Inc boundary survey of the Town Forest (2006)
- New Hampshire Wildlife Action Plan (2006)
- The Land Conservation Plan for New Hampshire's Coastal Watershed (2006)
- Site visits by Ibis Wildlife Consulting (2008)

Unfragmented Landscape

Unfragmented forest blocks are large areas of habitat with few or no roads, houses, or other development. In southeastern New Hampshire, blocks of 1,000 acres or more are considered regionally significant and blocks of 500-1,000 acres may also be locally significant. A large unfragmented block of habitat typically has greater capacity to support interior forest species (e.g., scarlet tanager, wood thrush), greater ability to

[1] New Hampshire Fish and Game Department. 2005. New Hampshire Wildlife Action Plan. Concord, NH.
[2] Sperduto, D.D., and W.F. Nichols. 2004. Natural Communities of New Hampshire. NH Natural Heritage Bureau, Concord, NH.

sustain natural processes, including resilience to natural disturbances, and often encompasses a diversity of habitats in close proximity to each other.

The New Hampshire Fish and Game Department (NHFG) identified development (residential, commercial, or industrial) as one of the most significant risk factors to the State's wildlife and habitats (NHFG 2006). Development causes the fragmentation of habitat into small, unconnected parcels. Songbirds, small mammals, and other wildlife species are more susceptible to mid-sized predators such as fox, raccoon, and skunk in small blocks of habitat. These "generalist" predators adapt better than other species to a fragmented landscape. Habitat blocks crisscrossed with residential roads and houses expose wildlife to high rates of road mortality, increase conflicts with humans and pets, result in increased contaminated runoff, and offer more opportunities for invasive plants to spread to natural areas.

The Danville Town Forest is over 400 acres, and lies within a larger 1000+-acre unfragmented block of habitat. However, development pressures continue to shrink this unfragmented habitat and connectivity for wildlife to other unfragmented habitats in the region is diminishing. Thirty-five years ago the Town Forest was part of a 3600+ unfragmented habitat that extended to the Cub Ponds in Sandown; by 2002 the block had shrunk to 1,200+ acres (Moreno 2002). Placing a conservation easement on the Town Forest will ensure that this ownership remains unfragmented in perpetuity.

Topography and Soils

As shown on the topographic map (Map 4) the highest point in the Town Forest is 320-feet in the northeast corner atop the hill near the old cemetery. From there the land slopes to the southeast and southwest toward the major wetland drainages.

The factors that most determine the soil types found in southeastern New Hampshire are parent material and slope or topography[3]. The Danville Town Forest supports a diversity of soil types, formed from several different kinds of parent material: glacial till, glacial outwash, or organic material (see Table 2 and Map 5). Most of the Town Forest is considered either very stony or is wetland soils.

The well drained glacial till soils (Chatfield-Hollis-Canton complex, Canton, and Scituate-Newfields complex) are found on the hills, knolls, and ridges of the Town Forest. These are all considered productive forest soils. The Chatfield-Hollis-Canton (C-H-C) complex usually indicates shallow to bedrock conditions and is the most common soil type in the Town Forest. Canton soils are deeper and more productive than the C-H-C complex.

The glacial outwash soils form in the lower slopes and valleys, along streams and wetlands. These soils (Hinckley, Walpole, and Pipestone) vary in their drainage characteristics. The Hinckley fine sandy loam is excessively drained with fine sandy loam at the surface and gravelly coarse sand below, and is a productive forest soil. Walpole and pipestone are poorly drained and are found around some of the wetlands.

The final group of soils, derived from organic material, underlies the wetlands in the Town Forest. The pits, sand, and gravel soil type represents the small gravel pit along Tuckertown Road. It is characterized as such because the topsoil was removed.

[3] United States Department of Agriculture Soil Conservation Service. 1994. Soil survey of Rockingham County, New Hampshire.

There are no prime farmland soils or soils of statewide importance for agriculture in the Town Forest. However one soil type--Canton gravelly fine sandy loam at 3-8% slopes (43B)--in the Town Forest is considered a farmland soil of local importance.

Table 2. Soil Types on the Danville Town Forest (also see Map 5)

Soil #	Soil Name	Acres	Drainage	Parent Material
Wetland soils				
295	Greenwood mucky peat	105	very poorly drained	organic
495	Ossipee mucky peat	12	very poorly drained	organic
125	Scarboro muck, very stony	10	very poorly drained	organic
395	Chocorua mucky peat	6	very poorly drained	organic
97	Greenwood and Ossipee soils, ponded	1	very poorly drained	organic
Subtotal		134		
Upland soils				
140C	Chatfield-Hollis-Canton complex	84	well-drained	glacial till
43C	Canton gravelly fine sandy loam	63	well-drained	glacial till
140B	Chatfield-Hollis-Canton complex	33	well-drained	glacial till
43B	Canton gravelly fine sandy loam	30	well-drained	glacial till
140D	Chatfield-Hollis-Canton complex	26	well-drained	glacial till
12B	Hinckley fine sandy loam	24	excessively drained	glacial outwash
314A	Pipestone sand	10	somewhat poorly drained	glacial outwash
547B	Walpole very fine sandy loam	8	poorly drained	glacial outwash
43D	Canton gravelly fine sandy loam	5	well-drained	glacial till
12C	Hinckley fine sandy loam	5	excessively drained	glacial outwash
447B	Scituate-Newfields complex	1	moderately well-drained	glacial till
12A	Hinckley fine sandy loam	<1	excessively drained	glacial outwash
298	Pits, sand, and gravel	<1		
Subtotal		289		

Watersheds, Wetland Systems, and Water Resources

Watersheds

Danville lies within two regional watersheds. Twenty-six percent of the town falls within the Exeter River Watershed and the remainder (74%) falls within the Powwow River Watershed. Drainage from the northwest and west sections of the Town Forest flows north into the Exeter River Watershed, which eventually flows east into Great Bay. The southerly and eastern portion of the Town Forest drains south and encompasses a portion of the Powwow River headwaters, which eventually drains into the Merrimack River (Map 6).

Upper Exeter River Conservation Focus Area

In 2006, The Nature Conservancy, Society for the Protection of NH Forests, and the Rockingham and Strafford Regional Planning Commissions published *The Land Conservation Plan for New Hampshire's Coastal Watersheds* ("The Coastal Plan). New Hampshire's coastal watersheds span 990 square miles or approximately 633,000 acres and 46 towns, including part of Danville. The authors identified 75 Conservation Focus Areas that comprise over 190,000 acres or 36% of the coastal watersheds that are of exceptional significance for living resources and water quality. Each Conservation Focus Area comprises a Core Area that contains the primary natural features and habitat for which the focus area was identified. Some focus areas also include Supporting Natural Landscape, which is composed of natural lands that helps safeguard the Core Area while also providing habitat for many common species. The Danville Town Forest lies within one of the 75 Conservation Focus Area identified as Upper Exeter River and encompasses both Core Area and Supporting Natural Landscape (Map 7).

Wetland Systems

A significant feature of the Danville Town Forest is the extensive network of wetlands that include large and small wetlands, vernal pools, perennial and intermittent streams (Map 6). Wetland soils comprise approximately 135 acres or 32 % of the Town Forest.

Freshwater wetlands are grouped into several general categories in New Hampshire: open water-emergent wetlands, scrub-shrub wetlands, forested wetlands, and peatlands. Emergent wetlands are marshes with a mix of open water, floating-leaved vegetation, and herbaceous growth in standing water. Shrubs such as speckled alder, silky dogwood, winterberry, sweet pepperbush, nannyberry, and typically a few saplings of red maple or other trees dominate the scrub-shrub wetlands. Forested wetlands are associated with slow-moving streams and beaver flowages and support trees, particularly red maple. Peatlands are a wetland type with low nutrient content and higher acidity caused by limited groundwater input and surface runoff.

Approximately 43 acres of the Town Forest are forested wetlands (Map 7). Red maple is the dominant overstory tree, although some are dominated by hemlock. Understory vegetation varies depending on the site and may include hemlock, yellow birch, American elm, white ash, black ash, and black gum (Moreno 2002). Forested wetlands typically have a diversity of understory shrubs and herbacesous plants along with abundant fallen trees and rotting stumps. Some forested wetlands are characterized as vernal pools.

The "Great Meadow" is a 56-acre wetland in the southeast corner of the Forest, with an active heron rookery, and is a prominent feature of the Town Forest. This large wetland and the other smaller wetlands located throughout the property are dynamic systems influenced by beaver activity. The importance of beaver to the wetland systems and associated wildlife is discussed in more detail below. These wetlands have open water areas that transition to emergent marsh then to scrub-shrub community and then to upland forest. The emergent marsh community includes duckweed, pond lily, and pickerelweed. Shrubs include winterberry, sweet pepperbush, highbush blueberry, and speckled alder. Standing dead trees interspersed in the open water are particularly evident in the Great Meadow. Perennial and intermittent (seasonal) streams connect many of the wetlands to one another, forming large wetland complexes.

Vernal pools are ephemeral wetlands that fill in spring from rainfall, snowmelt, or rising groundwater.[4][5] Some pools also fill in the fall after autumnal rains. These pools are typically small in size, ranging from less than 1/10th acre to more than 2 acres. Size, however, is not always an indicator of the quality or productivity of a vernal pool. Most vernal pools completely dry out by the end of summer and therefore can not support fish populations, which makes these pools safe for breeding amphibians such as wood frog, spotted and blue-spotted salamanders. The length of time that a pool retains water is known as its "hydroperiod." Most vernal pool breeders need about four months to complete their reproductive cycle. Pools that retain water for longer periods are also important, especially in drought years, when some pools may dry up too soon. Vernal pools vary in the animals that are present, yet most are characterized by the presence of at least one "indicator" species, one that depends on vernal pool habitat for successful reproduction. Vernal pool indicator species include fairy shrimp (small crustaceans), wood frog, spotted salamander, and blue-spotted and Jefferson salamanders.

Moreno (2002) documented 22 well-distributed vernal pools in the Town Forest (Map 7). These pools vary in size and most are isolated pools. Vegetation in around the vernal pools varies and includes moss, sedges, ferns, highbush blueberry, winterberry, red maple, and eastern hemlock. All are characterized by complete or partial canopy closure, which provides shade and maintains cooler water temperatures. Leaves and branches that fall from overstory or nearby vegetation form the basis of the food chain within these pools. A detailed animal survey of each of these vernal pools has not been completed; however several have been documented with one or more indicator species. Vernal pools are described in more detail below.

Headwater Streams

The health of larger rivers and streams is dependent on the health of smaller streams and wetlands farther up in the headwaters of a watershed. These small headwater streams may make up 80 percent of the stream network in a region and include both seasonal and year-round streams. Headwater streams may begin as trickles, seeps, or depressions that overflow and are often not named or mapped. Yet, the quality and integrity of these headwater streams is critical to downstream habitats.

The upper reaches of a watershed store water, recharge groundwater, and reduce the intensity and frequency of floods. Small streams are a critical link between land and water. Not only are they linked to upstream and downstream portions of the watershed, but water flowing from the land into the stream carries insects, leaves, soil, branches, and other material that are the start of a food chain. This exchange between land and water occurs in a transition zone along the edges of stream channels, called a riparian area. Maintaining connectivity between stream channels, stream bottoms and banks, and the riparian area is important to protect water quality and aquatic habitats. Much of the cleansing action and nutrient cycling in a stream occurs in saturated sediments, at the interface between stream water and the channel bottom and stream bank.[6]

The Town Forest supports several headwater streams and drainages that flow into Great Meadow forming a portion of the PowWow River headwaters. Likewise a few headwater streams flow into the Exeter River tributaries (Map 6).

[4] Kenney, L.P. and M.R. Burne. 2001. A field guide to the animals of vernal pools. Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts.
[5] Tappan, A. 1997. Identification and documentation of vernal pools in New Hampshire. New Hampshire Fish and Game Department, Concord, New Hampshire.
[6] American Rivers and the Sierra Club. 2007. Where Rivers are Born: The Scientific Imperative for Defending Small Streams and Watersheds.

Aquifers and Groundwater

Aquifers are concentrations of groundwater and those having medium to high potential to yield groundwater occur in the seacoast areas as alluvial deposits of sand and gravel ("unconsolidated") or in bedrock fractures ("consolidated"). The major source of recharge to these aquifers is through precipitation filtering directly down into the aquifer. The unconsolidated sand and gravel deposits are called "stratified drift aquifers" and typically yield more groundwater than bedrock fractures.

Danville relies primarily on groundwater as the primary source of its water supply. Danville has one medium potential aquifer (less than 1,000 gallons per day potential) located in the center of town, between the Kingston the Sandown Roads. The northwest corner of the Town Forest overlays this stratified drift aquifer (Danville Natural Resource Inventory) (Map 6).

Several wellhead protection areas, as delineated by NH Department of Environmental Sciences (DES), encompass a portion of the Town Forest (Map 6). These areas identify an area around groundwater wells that supply residential developments.

Upland Habitats

Upland forest and early successional habitat comprise approximately 289 acres or 68% of the Town Forest. The Danville Town Forest is considered a Hemlock-Hardwood-Pine "matrix" forest with some features characteristic of Appalachian-Oak Pine matrix forest (as defined in the NH Wildlife Action Plan). Within these broad matrix forest types are different patches or stands of trees. Moreno (2002) mapped thirteen different forest types (stands) based on the dominant tree species and age class.

The dominant tree species in the Town Forest are white pine, red oak, and hemlock. White oak, black oak, red pine, white birch, and black birch each comprise about one percent by volume of the tree species (Moreno 2002). Other tree species scattered throughout the Town Forest include shagbark hickory, sugar maple, white ash, yellow birch, bigtooth aspen, basswood, and American beech. The presence of black and white oak and shagbark hickory, which occur on the drier soils of slopes, ridges, or terraces in the Town Forest, reflect some of the aspects of Appalachian oak-pine forests.

Understory woody and herbaceous plants in these upland forests include witch hazel, maple-leaved viburnum, wintergreen, partridgeberry, sessile-leaved bellwort, Canada mayflower, wild sarsaparilla, starflower, goldthread, dwarf ginseng, ground pine, ground cedar, New York fern, spinulose wood fern, lady fern, among other plants. The amount of herbaceous ground cover and woody debris and shrub and undertstory diversity varies across the forest.

The powerline corridor offers early successional habitat and comprises 18 acres or 4% of the Town Forest. Young hardwood forest, about 30 years old, occurs on about 14 acres. The remaining upland forest is 50-100+ years old, with a few older trees. The forest will continue to mature naturally, except where disturbance sets back succession.

Early Successional/Young Forest

The powerline corridor in the western section of the Forest supports "permanent" early successional upland (and some wetland) habitat, maintained through periodic mowing by PSNH (Map 7). Although a highly disturbed habitat, the shrub and young tree community supports a unique set of wildlife species (e.g., prairie warbler), not found on the rest of the Town Forest. The diversity of plant species includes raspberry, blackberry, silky dogwood, highbush blueberry, speckled alder, quaking and bigtooth aspen, willow sp, staghorn sumac, pin cherry, gray birch, and red oak, among other species This diversity

provides food sources, cover, nest sites, and escape areas for many wildlife as discussed below. This area is also used by motorized recreational vehicles, and it is not clear what impact these are having on the productivity of wildlife in this corridor.

Moreno (2002) mapped and described approximately14.5-acres of early successional habitat or young forest in several small patches in the Town Forest (Map 7). Without further disturbance these patches are naturally succeeding beyond the early successional stage and into a young sapling/pole forest. Tree species include gray birch, paper birch, red maple, witchhazel, white pine, white oak, and red oak. Returning these area to an earlier successional stage would require active management, as recommended by Moreno (2002).

Mature Hardwood Forest
The Town Forest has extensive hardwood and mixed hardwood stands that are dominated with red oak, with a mix of black oak, white oak, American beech, black birch, white birch, and white pine. These forests produce abundant acorn crops for wildlife as well as capacity for producing high quality wood products. The diversity of herbaceous plants, shrub and sapling composition and diversity and woody devris is relatively low in most of these forests.

Mature Mixed Hardwood/Softwood Forest
These mixed forests are found throughout the Town Forest, but are most evident in the western portion (Moreno 2002). The tree species diversity is greater in these forests, including a mix of hardwoods (e.g., red oak, red maple, black and white birches, American beech) and softwoods (e.g., white pine, hemlock). The vertical layering with the forest understory is more diverse, perhaps a result of varying land use histories and disturbances.

Softwood Forest
Softwood forests in the Town Forest include small pockets of 75+ year old white pine stands scattered throughout the forest (Moreno 2002). Typically these are stands that have grown in after a field or pasture was abandoned. These stands offer some habitat for roosting owls or hawks, or other birds during winter, but lack tree species diversity and vertical structure that would attract greater wildlife diversity. The same is true for the one-acre red pine plantation near the old gravel pit. Scattered oaks and other mast trees in the midst of the pines, provides opportunities for future habitat management.

Forested wetlands dominated by hemlock and the upland hemlock-hardwood stands offer more vegetation diversity and structure and in turn support more wildlife diversity. Closed-canopy hemlock forests provide high quality winter shelter for white-tailed deer and wintering birds. Snow depths and wind chills are significantly lower in these forests, which is particularly important during harsh winters.

Wildlife and Their Habitats

Wildlife need food, water, cover, and space to live and reproduce--collectively known as their *habitat.* Each species has unique habitat requirements, and the presence of a given species in an area varies depending on the availability of the habitat features that they depend on. Wildlife food resources include aquatic and upland plants, fruits, seeds and nuts, insects and other animals, and nectar. All wildlife require water, almost daily, yet aquatic organisms clearly depend on it more than upland species. Cover provides protection from weather and predators and sites for nesting, resting, travel, and other activities. The juxtaposition of food, water, and cover determines the wildlife community that occurs in a given area.

An area with many different kinds of food, water, and cover typically supports a greater diversity of wildlife. This reflects *habitat structure*, an important concept in understanding the distribution and abundance of wildlife. The components of habitat structure and their presence or lack therefore on the Danville Town Forest are discussed below.

- **Horizontal vegetation diversity**

This refers to the horizontal arrangement of different plant communities (including type and age) in a given area. Areas with aquatic habitats and non-forest habitats such as fields as well as forest are more horizontally diverse than an area that is just forested. For instance, a 100-acre mature hardwood forest has less horizontal vegetation diversity than another 100-acre habitat that supports a mix of emergent wetland, shrubs, and upland mixed forest. Likewise, a 100-acre forest that has a mix of tree ages that includes a grassy opening, young forest, saplings, and mature, old trees is more diverse than a 100-acre forest with just sapling/pole-sized trees. A wetland that has concentric rings of open water, emergent marsh, shrub thicket, and tall trees is more horizontally diverse than an open water pond with a sandy shore that extends to lawn.

Looking at the Danville Town Forest in its entirety, the horizontal vegetation diversity offers a variety of different habitat conditions that include:

- Mature hardwood forest
- Mature mixed hardwood/softwood forest
- Early successional habitat/powerline corridor
- Wetland complexes that include open water-emergent marsh-scrub shrub-forested wetland

Habitat management can change and enhance horizontal diversity through diversifying the age, size, and structure of the forest habitats. Natural disturbances, including beaver, are important drivers of horizontal diversity.

- **Vertical vegetation diversity**

Vertical diversity refers to the extent of layering within a forest or other habitat. Layering within a forest includes the arrangement of ground cover (lichens, moss, ferns, herbaceous plants), vines and shrubs, and trees (including sizes and ages). The greater the variety of vertical layers, the greater the diversity of habitat, the greater the diversity of wildlife. These layers provide cover from predators, nest and den sites, foraging surfaces, food sources, shade, and more. Vertebrate wildlife typically respond more to vegetation structure than to the presence of specific plant species. Vertical and horizontal structure that is varied, lush, and “messy” is a boon to wildlife. Forests with little ground cover, dead wood, shrubs, and understory have fewer wildlife species.

The Danville Town Forest, like most forests in New England, is still recovering from the period of intense agriculture and natural reforestation. Some of the Town Forest is even-aged or two-aged, having grown back at the time a field or pasture was abandoned or the forest heavily logged. In time, perhaps hundreds of years, a natural disturbance pattern will create a richer vertical diversity that was thought to have been present in pre-settlement forests. Natural disturbances will continue yet not as extensively as in historic times, since humans have eliminated (fire), restricted (beaver), or otherwise altered natural disturbance patterns; hence a role for humans in replicating some natural disturbances. Active management, through selective habitat management or forestry, can serve to emulate disturbance, creating more diversity for wildlife.

- **Food Resources**

The availability of food resources for wildlife is a key component of their habitat needs, and often varies seasonally. Breeding birds depend on a flush of insects to feed their young nestlings, while later in summer and into fall and winter they switch to berries, nuts, and seeds. Deer, moose, and other browsers rely on herbaceous vegetation during the growing season and woody growth in winter. Larger mammals such as coyote, fox, and fisher prey on other animals as well as eating fruits when available. Seeds are favorites of squirrels, nuthatches, siskins, mice, and voles.

Fruits, nuts, and seeds from woody plants that are food for wildlife are collectively known as "mast." Hard mast includes the array of nuts and seeds, which are typically high in fat, carbohydrates, and protein, a food source that is both high in energy content and available into the winter. Soft mast includes fruits and berries such as cherries, dogwoods, blueberries, winterberry, grapes, and the fleshy fruits of other trees, shrubs, and vines. Soft mast is more perishable and is often high in sugar, vitamins, and carbohydrates. These fruits are a source of moisture for wildlife during drought years, and are a crucial energy source for some migrating songbirds.

A diversity of hard and soft mast producing trees, shrubs, and vines is important. Different mast species are available at different times of year, which is critical to wildlife. Also, some species, such as oak only produce heavy acorn crops every 2 to 10 years, and this varies among oak species. Peak acorn production occurs when red oak are 19-22 inches in diameter at breast height (dbh); white oak at 24-30 inches dbh. White oak acorns have less tannin and hence are more palatable to wildlife than red or black oak acorns. Birches, maples, ashes, and basswood are also used by seed-eating wildlife.[7]

The Danville Town Forest has abundant oaks, including red, white, and black, but few other hard mast species in great abundance. Soft mast species in the Town Forest include highbush blueberry, winterberry and dogwoods in and around wetlands, and cherries, raspberries, dogwoods, viburnums and sumac in the powerline corridor. The Town Forest has a healthy supply of white pine and hemlock, a source of seeds for birds and mammals. The upland forest currently produces little soft mast (fleshy fruits) for wildlife.

- **Cavity trees, live and dead and dying**

Nearly two-dozen birds and mammals depend on tree cavities for nesting, roosting, or denning. At one species, the brown creeper nests under the loose bark on standing trees. These species require a range of cavity tree size classes and rely on a mix of dead or partially dead standing trees (called "snags") as well as live trees with cavities. Woodpeckers, chickadees, and red-breasted nuthatch are primary excavators (i.e., they make the holes), while others use existing holes.

The Danville Town Forest has cavity trees scattered throughout, although the number of such trees is limited, particularly the large sizes. Some of the wildlife species found on the Forest and their required tree cavity sizes (diameter at breast height) include:

<8"	6-12"	12-18"
black-capped chickadee	hairy woodpecker	great-crested flycatcher
downy woodpecker	red-breasted nuthatch	
tufted titmouse	white-breasted nuthatch	
winter wren	brown creeper	

[7] New Hampshire Forest Sustainability Standards Work Team. 1997. Good forestry in the Granite State: recommended voluntary forest management practices for New Hampshire. Concord, New Hampshire.

>18"	>24"
wood duck	raccoon
hooded merganser	
pileated woodpecker	
gray squirrel	
red squirrel	
porcupine	

- **Dead and down woody debris**

Dead and down woody debris (often called "coarse woody debris") on the forest floor is important for many reasons. Woody debris in various stages of decay includes logs, stumps, branches, upturned roots, and tree falls. These features provide wildlife habitat, serve as nurse logs for regeneration plants, and contribute to nutrient cycling. As with cavity trees, the larger the fallen log or stump the greater the biodiversity value. Decaying wood supports many insects and other invertebrates, which are food sources for shrews, woodpeckers, and black bears. Snakes, fisher, and weasels hunt among the woody debris. Many species including mice, voles, salamanders, snakes, chipmunks, red squirrels, weasels, black bear use coarse woody debris for cover, den sites, and escape areas. The winter wren nests in upturned tree roots. Mosses, fungi, and lichen are often associated with decaying wood. Fallen logs and other woody debris are also important in aquatic environments. Turtles, mink, otter, and waterfowl bask on this wood and fish find cover in woody debris.[8]

As with cavity trees, the Danville Town Forest is low in coarse woody debris. This is not atypical in New England forests that are recovering from past agriculture and intensive logging. The size of coarse woody debris is related to past land use since large trees and dying trees are often removed before they reach the stage of decaying on the ground. The amount and size of woody debris is naturally increasing as New Hampshire forests are maturing, assuming not all is removed.

- **Inclusions**

Inclusions are small patches of trees that are different form the majority of the surrounding forest. For example, a patch of hemlock in a primarily hardwood stand, or a few oaks in a primarily softwood stand are inclusions. These inclusions increase the habitat diversity in what could be an otherwise homogenous habitat type, and therefore often support more wildlife. A black-capped chickadee finds cover on a cold winter day in a hemlock nestled among a stand of hardwoods. A few hemlock in a hardwood stand may be enough to support a blue-headed vireo, which typically occurs in a more conifer-dominated stand. Inclusions are by nature small in scale, and should be considered during forest management planning and implementation.

Wildlife-Habitat Associations

The types and sizes of vegetation and other structural features determine the wildlife that occurs in a given habitat. The Danville Town Forest supports several different habitat types that support a unique set of wildlife species (Map 7). The presence or abundance of a given wildlife species often depends on the availability of the structural features described above. A spreadsheet of plant and animal species documented in the Town Forest is in Appendix D. Many other wildlife species are likely present, but are either difficult to detect or are active at other times of year than when these data were gathered. Also, no

[8] New Hampshire Forest Sustainability Standards Work Team. 1997. Good forestry in the Granite State: recommended voluntary forest management practices for New Hampshire. Concord, New Hampshire.

systematic survey of invertebrates or plants has been conducted. This species list can be augmented over time by observations of others.

The following habitats and associated wildlife are documented for the Town Forest and provide a good example of how some species are associated with certain habitat types. Some species are generalists, such as white-tailed deer, and occur in most if not all the habitats.

Oak and Oak-Pine Forest
Blue jay, white-breasted nuthatch, red-eyed vireo, wild turkey, pileated woodpecker, tufted titmouse, wood thrush, black-and-white warbler, ovenbird, scarlet tanager, American crow, gray squirrel, eastern chipmunk

Pine-Hemlock-Mixed Hardwoods
Blue-headed vireo, black-throated-green warbler, hermit thrush, pine warbler, winter wren, red squirrel, porcupine, fisher

Early Successional (Powerline)
Prairie warbler, chestnut-sided warbler, indigo bunting, eastern towhee, field sparrow, coyote

Wetlands: Open Water/Emergent Marsh
Beaver, otter, muskrat, bullfrog, hooded merganser, mallard, Canada goose, painted turtle, great blue heron

Wetlands: Scrub-Shrub and Forested
Beaver, mink, swamp sparrow, red-winged blackbird, common grackle, common yellowthroat, yellow warbler, tree swallow, eastern phoebe, great-blue heron, wood duck, red-shouldered hawk, veery, gray catbird, snowshoe hare

Wetlands: Vernal Pools
Wood frog, spotted salamander, blue-spotted salamander, spring peeper, gray treefrog

Vernal Pools
As noted, the Danville Town Forest harbors nearly two-dozen vernal pools. These pools are home to breeding amphibians including wood frog, spotted and blue-spotted salamander, as well as fairy shrimp. Spring peeper, gray treefrog, and American toad also breed in some of these vernal pools, although they also breed in other types of wetlands. Smaller organisms such as bacteria, fungi, zooplankton (e.g., daphnia), caddisfly and other insect larvae, crustaceans and insects are all food for the larger vertebrates within these vernal pools. Salamander larvae also eat other salamander larvae.

Adult amphibians travel to vernal pools in early spring (late March-May) to mate and lay eggs. For the other 11 months of the year, these salamanders and frogs live in the upland within a few hundred feet of the pool, and sometimes up to a ¼ mile away. Adult wood frogs are commonly seen hopping around on the forest floor; in winter they hibernate under logs, stumps, rocks, or leaf litter. The “mole” salamanders, including spotted and blue-spotted, spend most of the year under logs, in animal burrows, or other places below ground.

Vernal pools also serve as “stepping stones” for turtles, providing food and cover as they travel overland between larger wetlands. Snakes, raccoon, mink, and great-blue herons, among other wildlife species, occasional forage in vernal pools. A researcher in Massachusetts found the biomass of vernal pool amphibians to be greater than the biomass of all the birds and mammals combined in the upland forest

surrounding his study pool.[9] Clearly, these habitats and associated wildlife are key biological elements of the forested landscape. Maintaining suitable upland habitat conditions around vernal pools is as important as protecting the pools from disturbance. Canopy shade, deep leaf litter, and fallen trees and stumps are all important.

In the dry seasons vernal pools are often only noticeable in the forest as small depressions with compacted leaves or dark waterstains. Sometimes harvesting and recreational activities create depressions such as ruts, ditches, or borrow pits that fill with water. Amphibians may breed and lay eggs here, but usually these artificial pools dry up much sooner and are not comparable to natural vernal pools. The State of Maine developed a set of management guidelines for vernal pools that address the vernal pool depression, vernal pool protection zone (within 100 feet), and amphibian life zone (100-400 ft). These recommendations are addressed in Chapter 4.

Beaver Influenced Wetlands

Beaver are a key species in wetland systems as their activity creates habitat for many other plants and animals. This industrious rodent builds dams on perennial streams, flooding one or more acres upstream. This provides access to food, protection from terrestrial predators and shelter in winter, including underwater access to their lodge. Beaver feed on aquatic plants (e.g., water lily, duck potato, waterweed, pondweed, and duckweed) and shoots, twigs, leaves, roots, and bark of woody plants (e.g., aspen, willow, birches, witch hazel). They fell trees to get access to the tender leaves, twigs, and bark.

Eventually beavers abandon their pond, either when preferred food plants become scarce or when silt accumulation makes them too shallow. With beaver gone, the dam begins to break and the pond drains. In the nutrient rich silt, herbaceous plants flourish, forming "beaver meadows." Over time, shrubs and trees begin to dominate the area, creating ideal habitat again for beaver to return.[10] Beaver-influenced wetlands are dynamic, cycling through successional stages from flooded stream (pond) to marsh, shrubland, young forest, and then back to pond when the beaver return. Other wildlife that benefit from beaver-created habitats, also cycle through these changing habitat conditions.

The great-blue heron, a prominent and popular species in the Town Forest, is an associate of these beaver flowages. A heron rookery, once the second largest in the State, is still active (although much smaller now) on Rookery Pond, a portion of which is in the Town Forest. In recent years herons began nesting on Great Meadow. In 2008, each rookery supported about 13 active nests. As rising waters behind new beaver dams flood trees, they provide ideal nesting habitat for great blue heron colonies. Flooded areas provide protection from raccoons and other predators of heron nestlings. As flooded trees die, cavities form in them, providing nesting habitat for tree swallows, wood ducks, and hooded mergansers. Over time, the trees fall over, leaving herons, swallows and wood ducks to disperse elsewhere, perhaps to new beaver ponds. Eventually the Danville Town Forest herons will shift to a new site.

Beaver activity sometimes creates conflicts with humans through flooding of roads, trails, and woodlands. Flooding caused by beavers can kill trees that are considered ideal as future logs or other wood products. Tuckertown Road is currently flooded around the mid-section from beavers active in Great Meadow, preventing access by hikers and other recreational uses to the western section of the Town Forest. Hikers, but not all-terrain vehicles, can take a longer trail around the wetland to reach the powerline and western portion of the Town Forest.

[9] Calhoun, A.J.K. and P. deMaynadier. 2004. Forestry habitat management guidelines for vernal pool wildlife. MCA Technical Paper No. 6, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.
[10] Jackson, S. and T. Decker, Beavers in Massachusetts. 2004. University of Massachusetts Cooperative Extension System, Massachusetts Division of Fisheries and Wildlife.

Rare Plants, Exemplary Plant Communities, and Threatened and Endangered Wildlife

The New Hampshire Natural Heritage Bureau (NHNHB) finds, tracks, and facilitates the protection of rare plants and exemplary natural communities. They also maintain information on rare wildlife in cooperation with the NH Fish and Game Department. Natural Heritage defines a natural community as "recurring assemblages of plants and animals found in particular physical environments." Each type of natural community has a unique set of environmental conditions that support certain species adapted to those conditions. Exemplary natural communities include nearly all examples of rare types and high-quality examples of common types (Sperduto and Nichols 2004). There are currently no known rare plant species or exemplary plant communities on the Danville Town Forest, although no formal inventory has been conducted here by the NHNHB. A more thorough plant inventory of the Great Meadow and other wetland drainages would be useful given the high plant diversity in these communities.

However several wildlife species documented in the Town Forest are considered "species of greatest conservation concern" by NHFG as described in the NH Wildlife Action Plan. These include blue-spotted salamander, Blanding's turtle, eastern towhee, great blue heron, palm warbler (migration), red-shouldered hawk, and veery. These species are associated with vernal pools (blue-spotted salamander), large wetlands (great blue heron, red-shouldered hawk, palm warbler, Blanding's turtle), early successional habitat (eastern towhee) and large unfragmented habitats (veery). The New Hampshire Fish and Game Department has proposed changes to the list of threatened and endangered species in New Hampshire; the Blanding's turtle is proposed as an endangered species. There is no other known threatened or endangered wildlife species in the Town Forest.

Invasive Species

Many factors affect forest health including air pollution, water pollution, introduced insects and diseases, invasive plants, and climate change. The global economy, with world-wide trade and transport, has brought greater numbers of introduced insects, diseases, and plants to the U.S. Non-native invasive plants have generated great concern, such that the New Hampshire Legislative passed an Invasive Species Act (RSA 430: 51-57) that says "No person shall knowingly collect, transport, sell, distribute, propagate, or transplant any living or any viable portion of a listed prohibited species including all the cultivars, varieties, and specified hybrids."

The concern about non-native invasive plants are the traits that allow them to out-compete native species. In places, this has led to decreased biological diversity, impacts to natural communities, loss of wildlife habitat, cropland and pasture, The traits of non-native invasive plants include high productivity, aggressive root systems, thrive on disturbance, habitat generalists, and a lack of predators.

The list of prohibited plants for New Hampshire include the following:

Acer platanoides	Norway Maple
Ailanthus altissima	Tree of Heaven
Alliaria petiolata	Garlic Mustard
Berberis thunbergii	Japanese Barberry
Berberis vulgaris	European Barberry
Butomous umbellate	Flowering Rush
Cabomba caroliniana	Fanwort
Celastrus orbiculatus	Oriental Bittersweet

Cynanchum nigrum	Black Swallow-wort
Cynanchum rossicum	Pale Swallow-wort
Egeria densa	Brazilian elodea
Elaeagnus umbellata	Autumn Olive
Euonymus alatus	Burning Bush
Heracleum mantegazzianum	Giant Hogweed
Hydrilla verticillata	Hydrilla
Hydrocharis morsus-ranae	European Frogbit
Iris pseudacorus	Water-flag
Ligustrum obtusifolium	Blunt-leaved Privet
Lonicera x bella	Showy Bush Honeysuckle
Lonicera japonica	Japanese Honeysuckle
Lonicera morrowii	Morrow's Honeysuckle
Lonicera tatarica	Tartarian Honeysuckle
Lythrum salicaria	Purple loosestrife
Myriophyllum aquaticum	Parrot Feather
Myriophyllum heterophyllum	Variable Milfoil
Myriophyllum spicatum	European Water-Milfoil
Najas minor	European Naiad
Nymphoides peltata	Yellow Floating Heart
Phragmites australis	Common Reed
Polygonum cuspidatum	Japanese Knotweed
Potomogeton crispus	Curly-leaf Pondweed
Rhamnus cathartica	Common Buckthorn
Rhamnus frangula	Glossy Buckthorn
Rosa multiflora	Multiflora Rose
Trapa nutans	Water Chestnut

The Danville Town Forest is relatively free of invasive species, however several purple loosestrife are growing along the flooded section of Tuckertown Road. These plants should be removed before they spread further. Regular monitoring for invasive species is recommended.

Public Uses, Trails, and Cultural and Historical Features

The Danville Town Forest has a long history of public use. As described earlier, the stonewalls found in parts of the Town Forest tell of a past land use (Map 2). Tuckertown Road and other woods roads tell of some past logging activity along with travel between Danville and Sandown. At this time, no other historic buildings are known to occur in the Town Forest.

The one+ mile Tuckertown Road, now a class A trail, is used extensively for a variety of outdoor recreation (including walking, nature observation, jogging, mountain biking, horseback riding, and motorized recreation) and educational walks. Tuckertown Road leads from Rte 111A to the PSNH powerline which is used for similar activities and continues on beyond the Town Forest. A secondary woods road leads from Tuckertown Road west of the Great Meadow drainage north toward Rookery Pond and then turns west to the powerline. Several other older woods roads and trails lead from these main arteries.

Recently the Forestry Committee constructed a small parking lot off Route 111A. This is the main access to the Town Forest. A kiosk provides information about the Town Forest. Trails lead from here to Great Meadow, offering views of the great blue heron rookery, and meander to Tuckertown Road (Map 2).

The Town Forest is open to hunting and fishing. Camping is not allowed, except by special permission. Kayaking is possible in the Great Meadow, although access is difficult.

Tuckertown Road and the PSNH utility corridor are open to motorized recreation, including snowmobiles and other off-highway recreational vehicles (OHRV). However, some OHRV users are using the trails north of Tuckertown Road, which is creating rutting and erosion in places where these trails cross wetland drainages or ascend steep slopes. This is particularly evident on the trail north of Tuckertown Road near the Great Meadow drainage.

An old gravel pit off Tuckertown Road is being used for target practice. In addition, the site is used to dump trash and spent cartridges are left at the site. Access to the site appears to be via the powerline corridor.

The 20-acre parcel off Happy Hollow Road does not have formal trails since access to the site is limited. A wetland located at the northern end of the parcel blocks easy access from the road. Access through abutting properties is not available at this time. However an informal trail is found at the southern end of the property appears to be actively used by motorized and non-motorized users.

Chapter 3 Stewardship Goals

As a community resource the Danville Town Forest offers many benefits and values including wildlife habitat, scenic beauty, clean air, cool temperatures, hiking trails and other outdoor recreation, wood products, water supply protection, flood storage, historical artifacts, among others. People value the Town Forest for many different reasons. Therefore, the stewardship goals must balance traditional and future uses of the Town Forest.

The following stewardship goals were developed for the Town Forest as a result of the meetings and discussions that were held to develop this Stewardship Plan and as a result of the drafting of the conservation easement deed with New Hampshire Audubon.

Stewardship Goals for the Danville Town Forest:

- To maintain and protect biological diversity and integrity that includes wildlife habitats, wetlands and water resources, and ecological processes
- To provide public access for low-impact outdoor recreation and natural resource education
- To retain in perpetuity for sustainable forestry to provide a source of wood products in balance with the other stewardship goals
- To preserve cultural and historic resources
- To retain scenic quality
- To provide for agricultural use of the farmland soils of significance if desired in the future

The vision for the Danville Town Forest is one that

- has a diversity of stand ages (including early successional habitat and older forest) of naturally occurring forest types with a range of sizes and types of downed woody debris, snag trees, cavity trees, and some very large/old trees
- supports the array of native habitats and associated plants and animals including any rare species and exemplary plant communities
- conserves and protects wetlands, riparian areas, other aquatic habitats, and water resources
- has high quality forest resources achieved through long-term stewardship and based on site capability
- retains long term soil productivity and lacks invasive plant and animals species
- offers outdoor recreational activities that enable public enjoyment and education of the forest's unique values and benefits while protecting the forest's resources
- provides a cultural history of this part of Danville

Chapter 4 Stewardship Recommendations

The stewardship of a community resource such as the Danville Town Forest is a long-term commitment by dedicated community members working together. The creation of this Stewardship Plan provides the foundation for moving forward on enhancing and maintaining this great public space. This Stewardship Plan is a living document to be reviewed and updated as part of the long-term stewardship of the Town Forest.

This Chapter provides stewardship recommendations for the Danville Town Forest. These recommendations were developed based on each of the stewardship goals and with consideration of existing conditions, site capabilities, specific stewardship issues, and feasibility and opportunity to achieve the desired outcome. The stewardship recommendations are organized by stewardship goal, although some issues and goals are interrelated and some are overarching. For example, the implementation of specific forestry operations is guided by the desire to protect wetlands and water resources and therefore addresses both the sustainable forestry and wetlands protection goals.

The stewardship recommendations vary in scope and include

- action items to be carried out by the Forestry Committee, Conservation Commission or others
- principles to abide by when conducting forestry or other management activities
- guidance on public use and recreation
- ideas for educational activities

Overarching Stewardship Recommendations

The following stewardship recommendations apply to the entire Town Forest and not to one particular stewardship goal:

Boundary maintenance

Clearly marked boundaries are an important part of the stewardship of the Danville Town Forest. Doucet Survey, Inc completed a boundary survey of the Town Forest in 2006. However, the boundary should be blazed and painted so you can readily identify the boundary while walking on the Property. This is particularly important when implementing timber harvesting and laying out trails to ensure that these activities are kept entirely within the boundaries of the Town Forest. Typically, surveyors leave behind colored flagging to temporarily mark the boundary line (in addition to any permanent monuments that mark corners or turns). This flagging will decay and disappear in a few years so it is helpful to complete the boundary line marking while this "information" is still out there.

Stewardship recommendations:

- Consult with all the abutters prior to blazing and painting the boundary. Some abutters may have already permanently marked their boundaries; these lines then don't need to be re-done.

- Follow standard procedures for painting and blazing the boundaries. Refer to UNH Cooperative Extension publication, *Woodlot Boundary Line Marking* available at http://extension.unh.edu/forestry/Docs/boundary.pdf. Volunteers can do this task or the Town can hire someone such as a licensed forester or land surveyor. Blazes may need to be re-painted every 10 years.

Working with neighbors

In addition to boundary marking, there are other reasons for "looking beyond the boundaries" to work collaboratively with the neighbors of the Town Forest. Because of proximity neighbors, may spend more time on or near the Town Forest and may be willing to help with volunteer activities such as maintaining trails and boundary lines. One of the community goals for the Town Forest is sustainable forestry. This may provide an opportunity to work with one or more neighbors on implementing some timber harvesting operations. The Town Forest is part of a larger unfragmented (undeveloped) block of land that extends to the north and west of the Property. This maintains a larger functional wildlife habitat and helps protect water quality. The Town can work with interested neighbors to help ensure that this unfragmented block remain; further development will diminish some of the natural resource values of the Town Forest.

Stewardship Recommendations:

- Meet with the neighbors to the Town Forest to discuss boundary marking, land conservation, volunteer opportunities, and other issues that may arise.

- Work with interested landowners to conserve additional lands abutting the Town Forest and lands that provide connectivity to other conserved lands. In particular, try to maintain connectivity around, among, and along wetland systems.

Stewardship Goal: To maintain and protect biological diversity and integrity that includes wildlife habitats, wetlands and water resources, and ecological processes

Maintain and protect vernal pools

Vernal pools are important, naturally occurring seasonal wetlands that lack perennial inlets and outlets, have no permanent fish populations, and support one or more indicator species. Moreno (2002) identified several dozen vernal pools on the Danville Town Forest, although surveys of animal life were not conducted of each pool and the precise location and circumference of each pool has not been delineated. Trail layout and forestry operations near vernal pools should be done to preserve the habitat features important to vernal pool species. Vernal pool breeders spend up to eleven months of the year in cool, moist upland habitat around the pool. Uplands with moist forest floor, loose, deep leaf litter, downed woody debris, and canopy shade is important for these species.

Stewardship Recommendations:

- In spring 2009 organize a volunteer-based survey of the vernal pools on the Danville Town Forest (use *Identification and Documentation of Vernal Pools in New Hampshire, A Field Guide to the Animals of Vernal Pools*, and *The Importance of Hydroperiod in Wetland Assessment*, for guidance and reference the map in Moreno 2002 as a guide to location of vernal pools). The survey should include a search of each pool for indicator species and other species and a GPS of the circumference of the vernal pool, which can be added to a GIS map of the Danville Town Forest. A spring survey can be combined with an evening educational program on vernal pools and other wetlands in the Town Forest.

- Management practices in and around vernal pools (for references see Calhoun and deMaynadier, 2004, Tarr and Babbitt 2008, and UNH Cooperative Extension *Habitat Stewardship Series: Vernal Pools,* 2007):

  The Pool
  - Leave the vernal pool undisturbed year-round. Avoid harvesting, heavy equipment operation, skidding, trails, or any activity that causes soil compaction in the pool
  - Keep the pool free of sediment, slash, and treetops from forestry or other activity
  - Leave slash or other woody debris that accidentally falls into the pool
  - Prior to any timber harvesting or other active management, flag the spring high water mark boundaries of vernal pools; especially important if harvesting occurs in dry season or winter when the outlines of the vernal pool are more difficult to discern. Recognize that year-to year fluctuations in precipitation affect water levels so drought years may not reflect full extent of the pool.

  Within 300-feet of a Vernal Pool
  - Let a 25-foot no-cut zone around vernal pools
  - Avoid creating recreational trails within 50-feet of a vernal pool and place at least 100-feet away if land slopes to the vernal pool
  - Avoid any activities that change water flow into the pool or changes to the water table
  - Avoid any runoff carrying pollutants or sediment into the pool
  - Where possible avoid disturbing fallen logs
  - Avoid use of chemicals
  - Conduct any forestry operations only during completely frozen or completely dry soil conditions. Do not create ruts and minimize soil disturbance and compaction
  - Leave a supply of older or dying trees to serve as recruitment for coarse woody debris
  - Avoid road or landing construction
  - Where possible keep skid trails 100-feet away from pool
  - Within a 100-foot zone around the vernal pool maintain deep litter and woody debris and a shaded (at least 75% canopy cover) forest
  - Within 100-300 foot zone around the vernal pool maintain a minimum average of >50% canopy cover, uniformly distributed and avoid canopy openings greater than 1 acre in size
  - Whenever possible, avoid the use of heavy machinery within 100-foot zone by using manual crews, directional felling, or cable winching for any forestry activity

Maintain and Protect Other Wetlands and Headwater Streams

More than 30 percent of the Town Forest is wetlands and these areas support a rich biological diversity and are critical for protecting water quality and maintaining flood control. The small streams (intermittent and perennial) in the upper reaches are a critical link between land and water. Not only are they linked to upstream and downstream portions of the watershed, but water flowing from the land into the stream carries insects, leaves, soil, branches, and other material that are the start of a food chain. This exchange between land and water occurs in a transition zone along the edges of stream channels, called a riparian area. Maintaining connectivity between stream channels, stream bottoms and banks, and the riparian area is important to protect water quality and aquatic habitats. Much of the cleansing action and nutrient cycling in a stream occurs in saturated sediments, at the interface between stream water and the channel bottom and stream bank. Riparian areas around wetlands are likewise important.

Stewardship Recommendations:

- Leave a 25-foot no cut zone along intermittent and perennial streams, scrub-shrub wetlands, and larger wetlands.

- Within a 100-foot zone along streams and wetlands:
    - maintain at least 75% canopy cover if present; exception to this is in specifically identified areas for early successional habitat (see below)
    - avoid any new roads or landings (stream crossings will occur and need to be built using best management practices)
    - leave trees with cavities, standing dead trees, and downed logs

- Regenerating hardwoods using small (1/4 to ½ acre) patch cuts near wetlands is beneficial to beavers. This is an exception to the 75% canopy cover above. These patch cuts should be located outside the 25-foot no-cut zone and be at least 660 feet away from the heron colonies.

- Continue to maintain and monitor the water level control device at the outlet to Great Meadows to adjust for water level fluctuations caused by beaver; determine maximum acreage of acceptable flooding in drainage recognizing that beaver-influenced wetlands are a dynamic system.

- Continue to assess the flooding located along the wetland drainage into Great Meadow located along a portion of Tuckertown Road. It is uncertain at this time if changes in beaver activity, changes in precipitation, or other changes to water flow are causing this flooding. Determine various options to this situation that range from leaving as is to adding culverts and materials to raise the road level high enough about flood stage.

Maintain and Enhance Early Successional Habitat

Early successional habitats--grasslands, shrublands, young forests--are declining in the northeast, a result of forest maturation, lack of natural disturbance, and loss of habitat to development. The region experienced a surge of early successional habitat following the clearing and then abandonment of farmland in the 1800s and early 1900s. So, the decline of wildlife species dependent on early successional habitat is not surprising as forests reclaim the landscape. However, there is concern that controls on natural disturbance (such as fire and beaver) and major land use changes from development are leading to a decline of early successional habitat below what may have existed historically. Hence, retaining and creating patches of early successional habitat within the forested landscape is seen as important to maintaining the range of biological diversity native to this region. In addition, there is a growing recognition of the importance of pollinators in nature and in maintaining agricultural crops and concern that there are widespread population declines among native pollinators such as bees, butterflies, moths, and hummingbirds. Maintaining a diversity of grasses, flowers, and shrubs that bloom at different times provides foraging habitat for native pollinators, and in the Town Forest this is best accomplished through maintaining some early successional habitat.

Stewardship Recommendations:

- Maintain contact with the Public Service of New Hampshire (PSNH) which manages the vegetation below the powerline corridor to ensure the continuation of a diverse shrub and sapling tree community that produces food resources (e.g., fruits, insects) and nesting sites for a unique wildlife community. Encourage PSNH to conduct vegetation management on frozen ground or on completely dry conditions (after the breeding season).

- Consult with PSNH on ways to address erosion, fires/burning of trash, dumping, recreational vehicles through wetlands, and related issues that are occurring along the powerline corridor.

- Annually monitor for invasive species along the powerline corridor, since this is a highly disturbed site and prone to invasive species getting established.

- Consider managing the old borrow (gravel) pit and surrounding young forest (currently ~30 years old) as early successional habitat. This is the best location and opportunity for creating and retaining this habitat type (besides the powerline) since it is easily accessible from Tuckertown Road, is already in a young but succeeding forest condition, and will help solve a stewardship issue related to the target shooting and dumping which occurs here. Consider the following steps for managing this site:
    - Refer to Moreno (2002) for an accurate map location of this site
    - Leave a 25-foot no cut buffer along Great Meadow
    - Maintain 7-acres as early successional habitat (young forest) by contracting a brontosaurus (or trained volunteers could do some of the work with chainsaws) to cut 1/3 of the area in 2009 and 1/3 of the area in 10 years; returning every 10 years to cut each third. Maintain the remaining 1/3 of the area (abutting Tuckertown Road) as tall herbaceous habitat to be mowed once a year in the fall. This herbeacous area can also be used as a log landing as needed. Grants are available from NH Fish and Game to help with these management activities.
    - Consider lowering (bulldozing) the exposed borrow pit to enhance the creation of early successional habitat and prevent future dumping, target shooting, and other activities that would degrade the habitat. Leaving some exposed soil is beneficial for early successional wildlife species including for turtle nesting sites.
    - During cutting of the young forest retain any fruiting shrubs such as sumac or hawthorn.

Monitor and Control Invasive Species

Non-native invasive plant species thrive in disturbed areas. Exposed soils offer prime sites for invasive species to colonize and spread. Trails and forest edges are often places where invasive plants first establish, either dispersed by animals and wind or carried unintentionally by people, pets, or vehicles. Invasive species are one of the major threats to the integrity of natural communities, second only to direct habitat loss. Preventing invasive plant species from becoming established in the Town Forest requires regular monitoring and some removal. A few clumps of purple loosestrife, a wetland invasive plant, were found along the flooded section of Tuckertown Road. Otherwise the Town Forest is relatively free of invasive plants at this time.

Stewardship Recommendations:

- Remove the existing purple loosestrife plants from Tuckertown Road using the following techniques as recommended by the Nashua Conservation Commission (see http://www.nashuarpc.org/envplanning/documents/SoRLAC/invasiveplants.pdf for more information):
    - **Prevention** can't be stated strongly enough. Loosestrife seeds germinate in moist, exposed soil and do especially well in disturbed areas. Avoid any water drawdown during the growing season when mudflats are exposed where seeds can germinate. Keep disturbance by construction equipment to a minimum and closely monitor disturbed sites.

- **Early Detection**: Survey disturbed sites at least every three years to pinpoint locations of new infestations, which are easier to control when small. Survey high risk areas, i.e., those near disturbance such culverts or beaver lodges annually.
- **Manual Pulling:** Early detection of the plant is important as small populations (less than 100 plants) and isolated stems are more successfully controlled than large, entrenched populations. Small populations of purple loosestrife may be removed by hand pulling. This method should be avoided after flowering so as not to scatter seed. The entire rootstock must be pulled out since regeneration from root fragments is possible. Be sure to minimize disturbances to the soil and native vegetative cover. Remove uprooted plants and broken stems from the area since the broken stems can resprout. Follow-up treatments may be needed in subsequent years to remove new plants, which sprout from seed persisting in the ground. Digging plants out is not recommended as this creates disturbance, which may favor the spread of the species.
- **Disposal:** All plant parts should be removed immediately from the site and properly disposed of. Once severed, stems are buoyant and may disperse to other areas and re-sprout.

- As part of routine annually monitoring of the Town Forest, look for any other invasive species, particularly in around wetlands, along trails and powerline. For more information on identifying invasive plant species in New Hampshire see the following publications and resources at http://extension.unh.edu/forestry/Docs/invasive.pdf; http://www.nashuarpc.org/envplanning/documents/SoRLAC/invasiveplants.pdf, and http://nbii-nin.ciesin.columbia.edu/ipane/index.htm

- Avoid introducing any non-native species onto the Town Forests when possible. Several local or regional sources of native plants are available if plantings are needed for any future restoration. Consult the New Hampshire State Forest Nursery (http://www.dred.state.nh.us/nhnursery/), New England Wildflower Society (http://www.newfs.org/), New England Wetland Plants Inc (http://www.newp.com/), or other sources of native plants.

Stewardship Goal: To provide public access for low-impact outdoor recreation and natural resource education

Maintain low-impact outdoor recreational trails

People visit the Town Forest on foot, mountain bike, cross-country skis, snowshoes, snowmobiles, all-terrain vehicles, or horseback. A stewardship challenge is to determine where these activities should occur in the Town Forest, given all the other stewardship goals. The Town Forest hosts many existing trails including Tuckertown Road, the powerline corridor, woods roads, and narrow footpaths. Some trails and the parking lot were developed recently. Public access and opportunities for low-impact outdoor recreation is a high priority and therefore requires planning. Some uses may need to be curtailed or restricted in their location if their continued use is causing habitat degradation or erosion.

Stewardship Recommendations:

- Any changes to the flooded section of Tuckertown Road should first consider the proper removal of the existing invasive purple loosestrife plants and ensure that any changes do not further spread the roots and seeds of this plant into the wetland system.

- Avoid creating recreational trails within 50-feet of a vernal pool and place trails so there is no change to water flow into or out of a vernal pool.

- Work with the Eagle Scouts on placement of the observation blind at the end of the blue trail and complete the blue trail so that it provides forest canopy cover to the entrance of the blind.

- Build a small bridge over the intermittent stream on the blue trail.

- Monitor the red trail as it runs by the Great Meadow heron rookery to ensure no erosion, that pedestrians stay on the trail and don't wander down to the wetland, and that the herons are not affected by human traffic on this section of the trail; if problems arise consider moving this section of the trail farther uphill on more level ground and away from the wetland.

- Before constructing any new recreational trails assess the condition of all existing trails and determine what types of recreational uses should be permitted on each trail.
    - Consider restricting the red and blue trails for pedestrian traffic only (not wheeled vehicles including mountain bikes or horses) and assess which other trails may be suitable for mountain bikes and/or horses; considerations include soils, topography, wetland proximity, erosion potential.
    - Until such time that the flooded section of Tuckertown Road is no longer flooded, prohibit off-highway recreational vehicles (except snowmobiles) in the Town Forest except for the powerline corridor. It is illegal to ride OHRVs through wetland and the existing condition seems to be encouraging illegal travel through wetlands on Tuckertown Road as well as the northerly woods road.
    - Consider placing large boulders at the entrance to the woods road that joins the powerline corridor in the northwest corner of the Town Forest to prevent motorized vehicles from traveling this woods road, which is also flooded in sections.
    - Continue to allow snowmobiling on the powerline corridor and Tuckertown Road (on frozen ice only, until conditions change); work with the local snowmobile club to help maintain these trails.

    - Annually monitor use of footpaths and trails during mud season to determine if seasonal trail closures are needed to prevent erosion and rutting.

Maintain compatible outdoor natural resource-based recreation

---

In addition to the uses that occur on the recreational trails, the entire Town Forest is open to hunting, as regulated by state hunting laws. It is unclear if camping and other overnight uses are allowed in the Town Forest; the recommendations provide some guidance on camping. A target practice area located along Tuckertown Road presents several stewardship issues and perhaps could be resolved by converting this location to a better use as an area of early successional wildlife habitat (see p 30).

Stewardship Recommendations:

- Continue to allow hunting as a natural resource-based educational activity that is compatible with the other stewardship goals. In the case of deer, hunting can help maintain their population at a level that minimizes deer over-browsing of herbaceous vegetation and regeneration.

- Prior to allowing any camping in the Town Forest evaluate the potential impacts of camping on the stewardship goals. Some of the considerations include dealing with human sanitation and waste disposal, assessing potential impacts from a concentrated public use, and risks from

campfires. If camping is to be allowed, a specific area within the Town Forest should be delineated and a process for allowing individuals or groups to camp should be established.

Continue to promote and host outdoor natural resource-based education programs

---

The Forestry Committee has hosted and widely promoted many educational walks in the Town Forest. The parking lot, kiosk, and educational trails that leave from the parking lot all contribute to the access to the Town Forest for outdoor education. The public process used to develop this Stewardship Plan including the online postings of meetings and draft documents and the televised meetings can be considered an educational program as it lets people learn more about the Town Forest. Engaging volunteers in trail monitoring, vernal pool surveys, winter tracking studies and other activities is another aspect of outdoor education.

Stewardship Recommendations:

- Conduct vernal pool survey (see p 27)

- Engage volunteers in other surveys such as:
  - searching for Blanding's turtles during the June breeding season
  - winter wildlife surveys (i.e., tracks, scat, chews, or other sign) to track the relative abundance of resident mammals such as snowshoe hare, fisher, weasel, otter, coyote, squirrel, and deer.
  - breeding bird surveys of the powerline corridor and other habitats
  - monitoring the heron rookeries during the breeding season

- Include on the kiosk, on the Town website, and on other educational materials information about trail uses, sensitivity of herons, responsible recreation including riding of off-highway recreational vehicles and mountain bikes, include where these activities are allowed in the Town Forest.

- During forestry operations post educational signs along trails that describe the purpose and anticipated outcome of the harvest.

Stewardship Goal: To retain in perpetuity for sustainable forestry to provide a source of wood products in balance with the other stewardship goals

Maintain and Enhance Upland Forests

Upland forest comprises about 65 percent of the Town Forest supporting a forest community that is part of a somewhat larger and still unfragmented landscape, although development is encroaching. The oak-pine and hemlock-hardwood-pine forests offer habitat for forest interior birds, cover for vernal pool amphibians and larger wildlife, potential wood products, clean air and cool temperatures, scenic pathways, and more. In essence these forests provide lots of different, sometimes overlapping benefits. Forestry (including timber harvesting) can be conducted in the Town Forest to enhance and protect these myriad values and in some cases is essential in meeting some of the town's stewardship goals (e.g., sustainable wood products, certain habitat conditions). This requires thoughtful planning and implementation.

Stewardship Recommendations:

- Through forest management promote a sustainable diverse forest with multiple ages and species composition that provides wood products in balance with the other stewardship goals.

- Maintain or enhance conditions for the array of native wildlife found here by implementing forest management that:
    - maintains or creates, where appropriate, a well-developed woody herbaceous and shrub layer beneath a well-developed but broken canopy (essentially an uneven-aged forest)
    - maintains large trees with three-pronged forks for nesting raptors
    - retains live trees with cavities and some standing dead trees
    - manages some oaks on a long rotation (100-125 years and 20-26" diameter at breast height)
    - leave tree limbs and other unused parts of harvested trees in the woods, not at landing, where feasible
    - follows the no-cut zones and other prescriptions described above under other stewardship goals

- Until the flooding of Tuckertown Road is addressed, access to the western part of the Town Forest for forest and habitat management is limited. Explore options for short- and long-term management access to the western part of the Town Forest through the Colby Pond Recreation Area and powerline corridor.

- Roads, skid trails, and log landings are a necessary part of forest management. These should be located with consideration to the principles outlined here and according to best management practices.

- In addition to the vernal pools, wetlands, and headwater streams, leave some areas of upland undisturbed or un-harvested for 150 years or more to promote old growth characteristics. These upland natural areas could include (see map of the Danville Town Forest showing physical and natural features by Moreno 2002; included here as Appendix F):

    - the northeast corner of the Town Forest framed by the steep ridge to the west, boundary line to the north, Rte 111A to the east, and a stonewall to the south. This area has several large trees of different species, wetlands, and stonewalls.
    - the uplands bordering the Great Meadows drainage, north of Tuckertown Road, extending to the respective trails on each side of the wetland drainage, and north to the boundary line.
    - the northern corner of the Town Forest between Rookery Pond to the east and the wetland drainage to the west, extending north to the Town Forest boundary and south to the woods road/trail

    These three areas total 61 acres and encompass 17 acres of wetland and 46 acres of upland.

- To protect heron rookeries, avoid any timber harvesting within 330 feet of a rookery (the nest trees) and conduct only singletree or micro-group (2-5 trees) selection within 330-660 feet of a rookery and avoid harvesting during the nesting season (April-August).

- Within a 50-foot zone of recreational trails and roads maintain at least 75% forest canopy cover (if present) by using single-tree or micro-group selection; exceptions to this include if tree

removal is important for safety or if for a specific wildlife habitat management goal such as the early successional habitat along Tuckertown Road.

- Avoid plantations of any sort; the existing red pine plantation should be managed to allow over time and/or through management the natural conversion to a mixed species forest

- Any log landings that are created as part of a forestry operation can also be maintained as early successional habitat. Once a log landing has been established and then the forestry operation is completed, the log landing can be left to re-vegetate naturally if erosion is not an issue. If erosion is a concern, then seeding the log landing with a conservation seed mix is appropriate. To maintain the log landings for future use they should be mowed every few years in the fall to prevent the establishment of woody growth.

- Limit or prohibit timber harvesting during mud season when roads and skid trails are especially susceptible to damage; conduct timber harvesting only on frozen ground or during dry conditions.

- Avoid skidding on recreational trails when possible.

- Designate "bumper trees" along skid trails and on sharp turns to minimize damage to residual trees.

- Work with Charlie Moreno, licensed consulting forester, to amend the 2002 Forest Management Plan by creating a revised forest management implementation strategy (harvest levels, locations, timing) that incorporates the principles described in this Stewardship Plan.

- As part of forest management planning and implementation ensure that the agricultural soils (43B) in the Town Forest remain productive for any potential future agricultural needs; this includes avoiding un-necessary compaction, rutting, and erosion.

Stewardship Goal: To preserve and conserve cultural and historic resources

Protect and maintain any known cultural and historic resources in the Town Forest

---

The Town Forest lies within an historic part of Danville. The historic Hawke Meetinghouse is located directly across the road from the Town Forest and entrance to Tuckertown Road. Just up the road on the opposite side is the "Ye Olde Cemetery," adjacent to the Town Forest. Stonewalls are evident along some boundaries and in a few other places within the Town Forest.

Stewardship Recommendations:

- Protect existing stonewalls during forest management, trail building, and other management activities; do not remove or damage stonewalls

- Include information about the history of the meeting house, cemetery, and stonewalls in educational materials about the Town Forest

- Add any new findings of cultural or historical artifacts found in the Town Forest to stewardship plan maps

Stewardship Goal: To retain scenic quality

Maintain the scenic values of the Danville Town Forest

Trees are known to be one of the most important scenic resources, particularly in urbanizing areas with houses and other development spreading over the landscape. The Danville Town Forest provides a forested backdrop as travelers drive along Rte 111A. Within the forest, visitors enjoy other scenic and aesthetic amenities including clear air, cool temperatures, views of water and wetlands, healthy soils, and quiet spaces. A diversity of habitats and viewsheds also adds to the scenic quality of a place. This Stewardship Plan outlines ways to enhance as well as protect scenic values along with fulfilling other stewardship goals. Some parts of forest management may appear unattractive to some eyes for a period of time. This may be because of the change in the viewshed or lack of knowing the purpose behind a particular management action. The management principles included in the Stewardship Plan provide an awareness of the purpose and goal behind each management action and ways to protect and enhance scenic values.

Stewardship Recommendations:

- Prior to conducting forest or habitat management, erect signs along trails (at viewsheds) that explain the purpose and goal behind the management actions.

- Follow the forest management stewardship recommendations for conducting management activities along trails and roads that includes minimal harvesting within 50 feet to maintain aesthetic experience.

- Continue to maintain and enhance the parking lot, kiosks, and trails to promote scenic enjoyment of the habitats and places within the Town Forest.

- Create early successional habitat in place of the target shooting and dumping area; this will lead to a more aesthetic experience for people walking along Tuckertown Road.

- Work with PSNH and users of off-highway recreational vehicles (OHRV) to eliminate or reduce the negative impacts of OHRV use in causing erosion, rutting, and illegal travel through wetlands that diminishes the enjoyment of trails as well as degrades water quality, habitats, and soils.

- Maintain some areas of the Town Forest as natural areas that will develop old growth characteristics overtime.

Stewardship Goal: To provide for agricultural use of the soils of agricultural significance if desired in the future

See ***stewardship recommendation*** under the sustainable forestry goal on page 35.

References

American Rivers and the Sierra Club. 2007. Where Rivers are Born: The Scientific Imperative for Defending Small Streams and Watersheds.

Calhoun, A.J.K. and P. deMaynadier. 2004. Forestry Habitat Management Guidelines for Vernal Pool Wildlife. MCA Technical Paper No. 6, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Doucet Survey, Inc. 2006. Plan of Land Danville Town Forest Tax Map 1, Lots 49 A & B, 52-54, 56, 57, 60-63, 68 & 69 & Tax Map 2, Lots 56 & 57 for the Town of Danville Route 111A & Happy Hollow Road, Danville, New Hampshire.

Jackson, S. and T. Decker, Beavers in Massachusetts. 2004. University of Massachusetts Cooperative Extension System, Massachusetts Division of Fisheries and Wildlife, Amherst, Massachusetts.

Kenney, L.P. and M.R. Burne. 2001. A Field Guide to the Animals of Vernal Pools. Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts.

Moreno. C. 2002. Forest Management Plan for the Danville Town Forest, Danville, New Hampshire. 2002. Prepared for the Citizens of Danville, New Hampshire, c/o the Danville Forestry Committee.

Nashua Conservation Commission. 2004. New Hampshire Invasive Species Fact Sheets. Nashua, New Hampshire. http://www.nashuarpc.org/envplanning/documents/SoRLAC/invasiveplants.pdf

New Hampshire Department of Agriculture. 2005. Guide to Invasive Upland Plant Species in New Hampshire. New Hampshire Department of Agriculture and New Hampshire Invasive Species Committee, Concord, New Hampshire. http://extension.unh.edu/forestry/Docs/invasive.pdf

New Hampshire Fish and Game Department. 2005. New Hampshire Wildlife Action Plan. Concord, New Hampshire. http://www.wildlife.state.nh.us/Wildlife/wildlife.htm

New Hampshire Forest Sustainability Standards Work Team. 1997. Good Forestry in the Granite State: Recommended Voluntary Forest Management Practices for New Hampshire. Concord, New Hampshire.

Sperduto, D.D., and W.F. Nichols. 2004. Natural Communities of New Hampshire. New Hampshire Natural Heritage Bureau, Division of Forests and Lands, Department of Resources and Economic Development, Concord, New Hampshire.

Tappan, A. 1997. Identification and documentation of vernal pools in New Hampshire. New Hampshire Fish and Game Department, Concord, New Hampshire.

Tarr, M and K.J. Babbitt. 2008.The Importance of Hydroperiod in Wetland Assessment. UNH Cooperative Extension, Durham, New Hampshire.
http://extension.unh.edu/Forestry/Docs/Hydroperiod.pdf

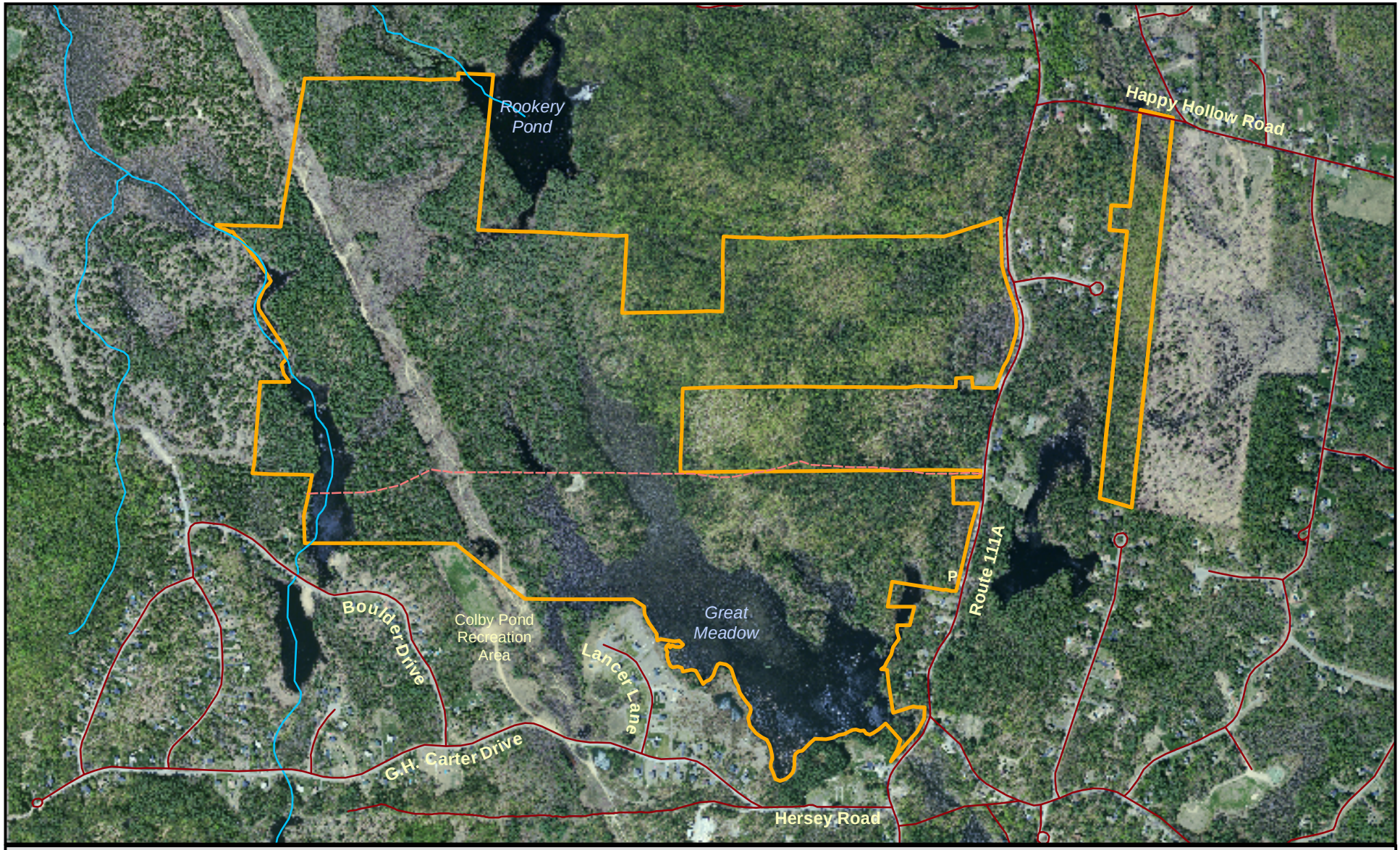
Danville Conservation Commission and Rockingham Planning Commission. 1998.Town of Danville, N.H. Natural Resource Inventory. Danville, New Hampshire.

Town of Danville. Zoning Ordinance: Articles III and XIII. Danville, New Hampshire.

United States Department of Agriculture Soil Conservation Service. 1994. Soil Survey of Rockingham County, New Hampshire.

UNH Cooperative Extension. 2007. Habitat Stewardship Series: Vernal Pools. Durham, New Hampshire. http://extension.unh.edu/Forestry/Docs/VernalPools.pdf

Wood, S. A. and K. Bennett. Woodlot Boundary Line Marking. UNH Cooperative Extension, Durham, New Hampshire. http://extension.unh.edu/forestry/Docs/boundary.pdf



Danville Town Forest
Tuckertown Road
River/Stream
Roads
P Parking Lot

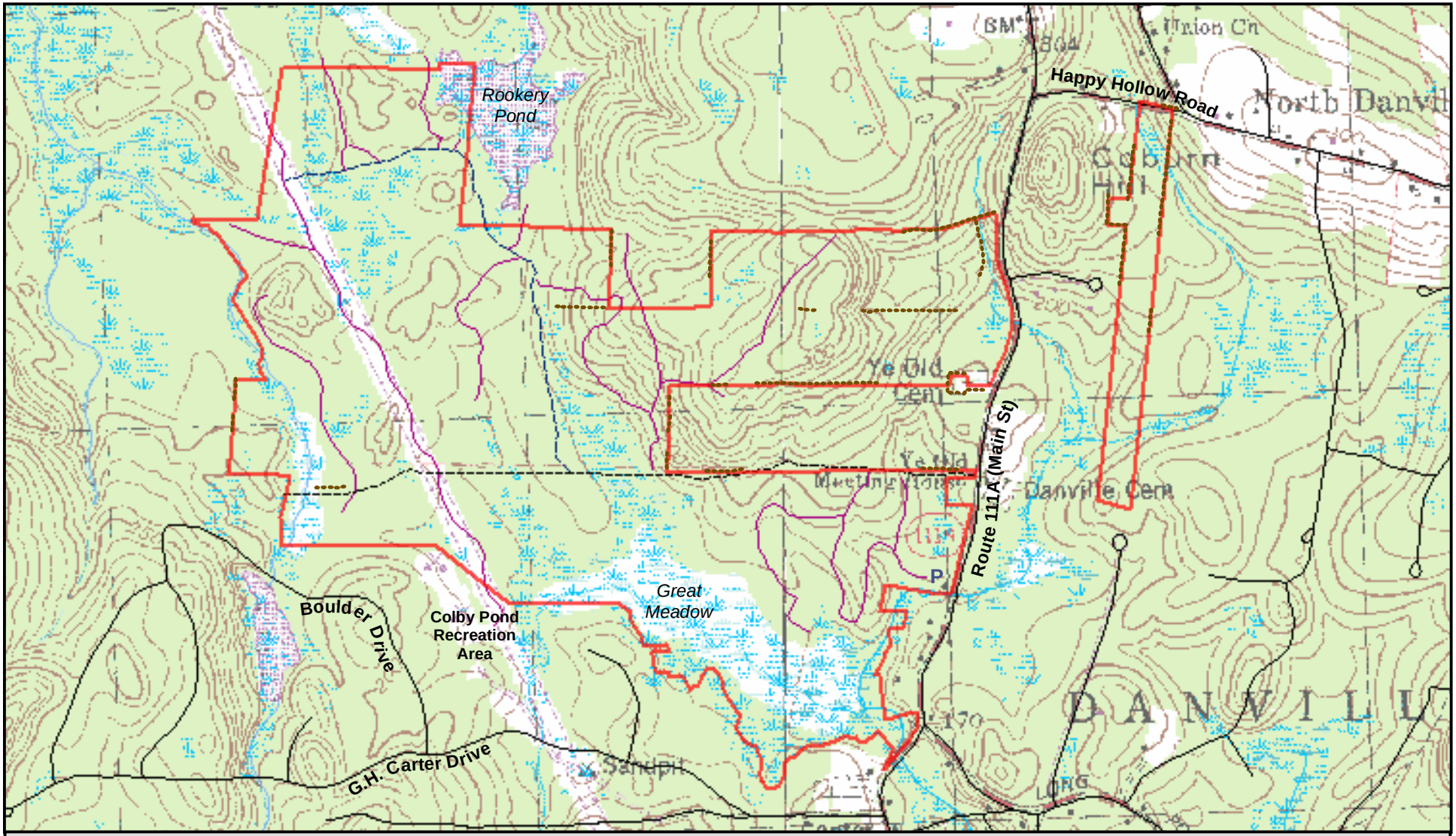
N

Map 1 Aerial Photo
Danville Town Forest
Danville, NH

0 1,000 2,000 Feet

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006. Boundary and feature locations are approximate. 1-foot resolution orthophoto taken May 2005 by Sanborn for NH DOT, supplied by NH GRANIT.

Map prepared by Ibis Wildlife Consulting September, 2008



Map 2 Trails and Cultural Features
Danville Town Forest
Danville, NH

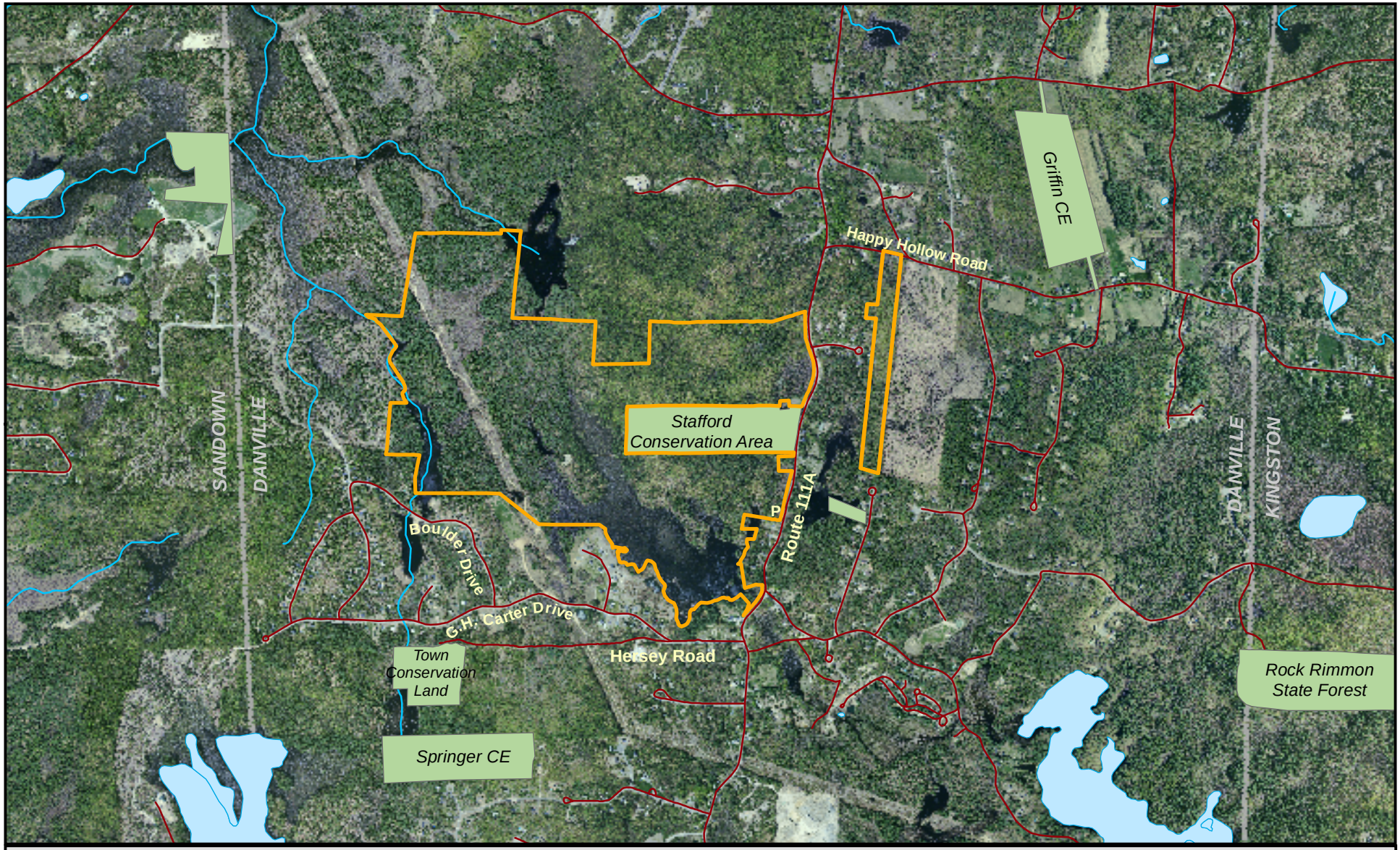
- Danville Town Forest
- Wetlands
- River/Stream
- Road
- P Parking
- Tuckertown Road
- Woods Road/Trail
- Footpaths/trails
- Stonewalls

N

0 1,000 2,000 Feet

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006. Water resource features from NH GRANIT. Wetlands from USFWS National Wetlands Inventory. Trails data from Moreno 2002 and 2008 site vists. Boundary & feature locations are approximate.

Map prepared by
Ibis Wildlife Consulting
September 2008



Danville Town Forest
Other Conservation Land
Roads
Town Boundary

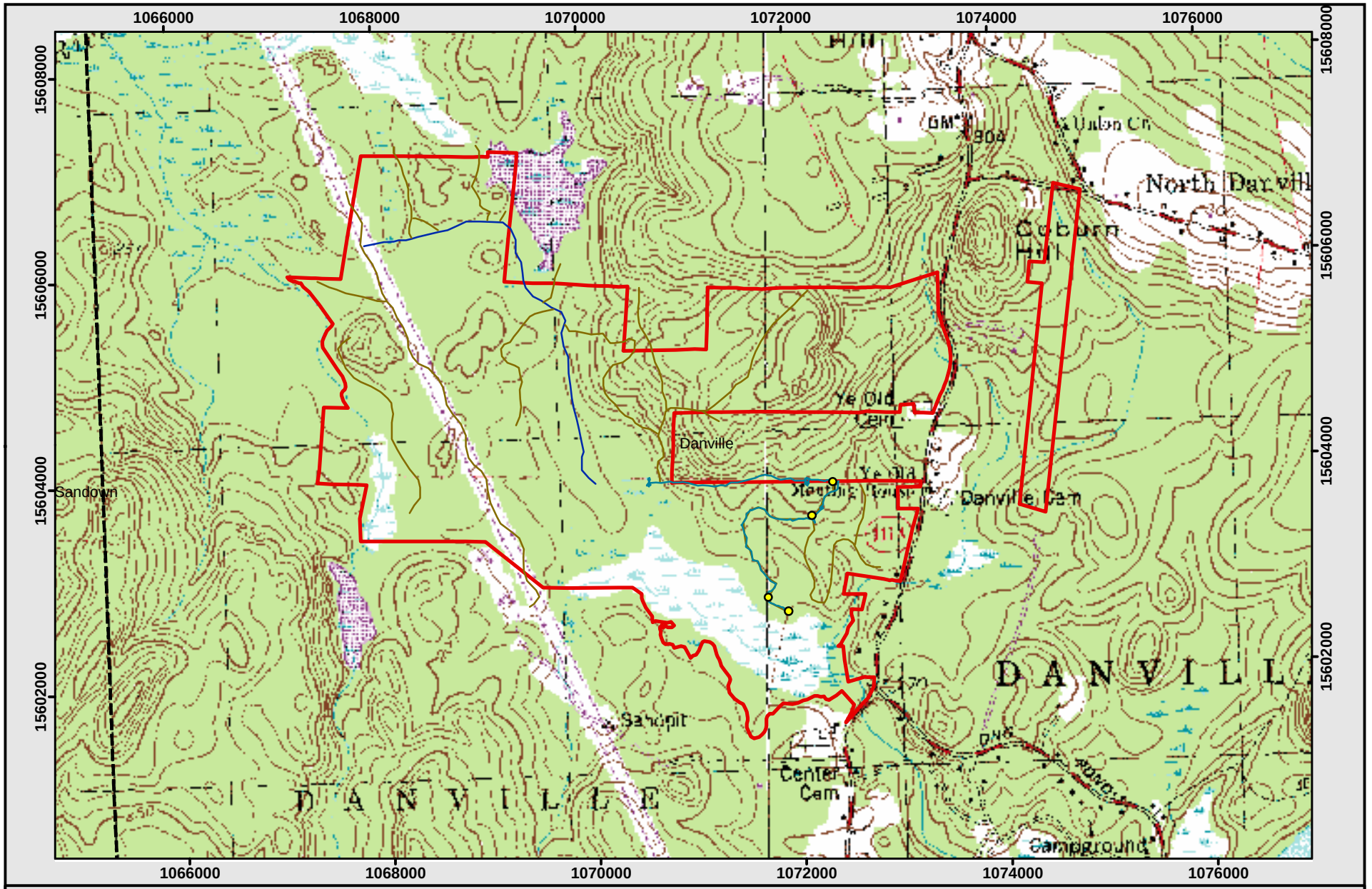
N

Map 3
Danville Town Forest and other Conservation Lands
Danville, NH

0 0.5 1 Miles

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006. Boundary and feature locations are approximate. 1-foot resolution orthophoto taken May 2005 by Sanborn for NH DOT, supplied by NH GRANIT. Conservation Lands from NH GRANIT, Southeast Land Trust of NH, and Rockingham Planning Commission.

Map prepared by
Ibis Wildlife Consulting
September 2008



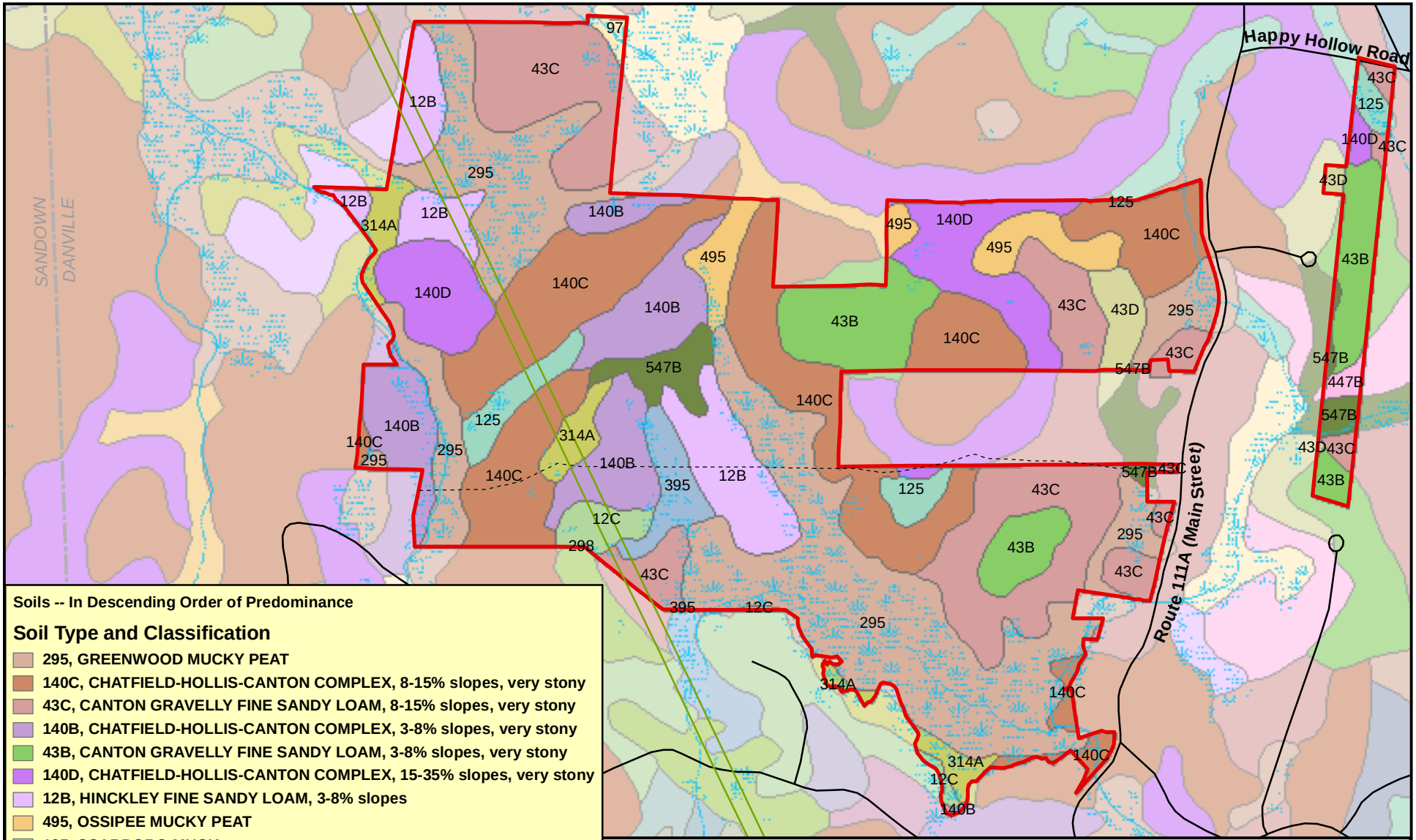
Map 4 Topography
Danville Town Forest
Danville, NH

Danville Town Forest

0 0.25 0.5 Miles

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006. Boundary and feature locations are approximate. USGS topographic base map (published 1970-1998) processed by NH GRANIT; coordinate system is NAD83 UTM Zone 19N meters.

Map prepared by
Ibis Wildlife Consulting
September 2008



Soils -- In Descending Order of Predominance

Soil Type and Classification

- 295, GREENWOOD MUCKY PEAT
- 140C, CHATFIELD-HOLLIS-CANTON COMPLEX, 8-15% slopes, very stony
- 43C, CANTON GRAVELLY FINE SANDY LOAM, 8-15% slopes, very stony
- 140B, CHATFIELD-HOLLIS-CANTON COMPLEX, 3-8% slopes, very stony
- 43B, CANTON GRAVELLY FINE SANDY LOAM, 3-8% slopes, very stony
- 140D, CHATFIELD-HOLLIS-CANTON COMPLEX, 15-35% slopes, very stony
- 12B, HINCKLEY FINE SANDY LOAM, 3-8% slopes
- 495, OSSIPEE MUCKY PEAT
- 125, SCARBORO MUCK, very stony
- 314A, PIPESTONE SAND, 0-5% slopes
- 547B, WALPOLE VERY FINE SANDY LOAM, 3-8% slopes, very stony
- 395, CHOCORUA MUCKY PEAT
- 43D, CANTON GRAVELLY FINE SANDY LOAM, 15-25% slopes, very stony
- 12C, HINCKLEY FINE SANDY LOAM, 8-15% slopes
- 447B, SCITUATE-NEWFIELDS COMPLEX, 3-8% slopes, very stony
- 97, GREENWOOD AND OSSIPEE SOILS, PONDED
- 12A, HINCKLEY FINE SANDY LOAM, 0-3% slopes
- 298, PITS, SAND AND GRAVEL

- Danville Town Forest
- Tuckertown Road
- Waterbody
- Wetland
- Town Boundary
- Road
- Powerline Corridor

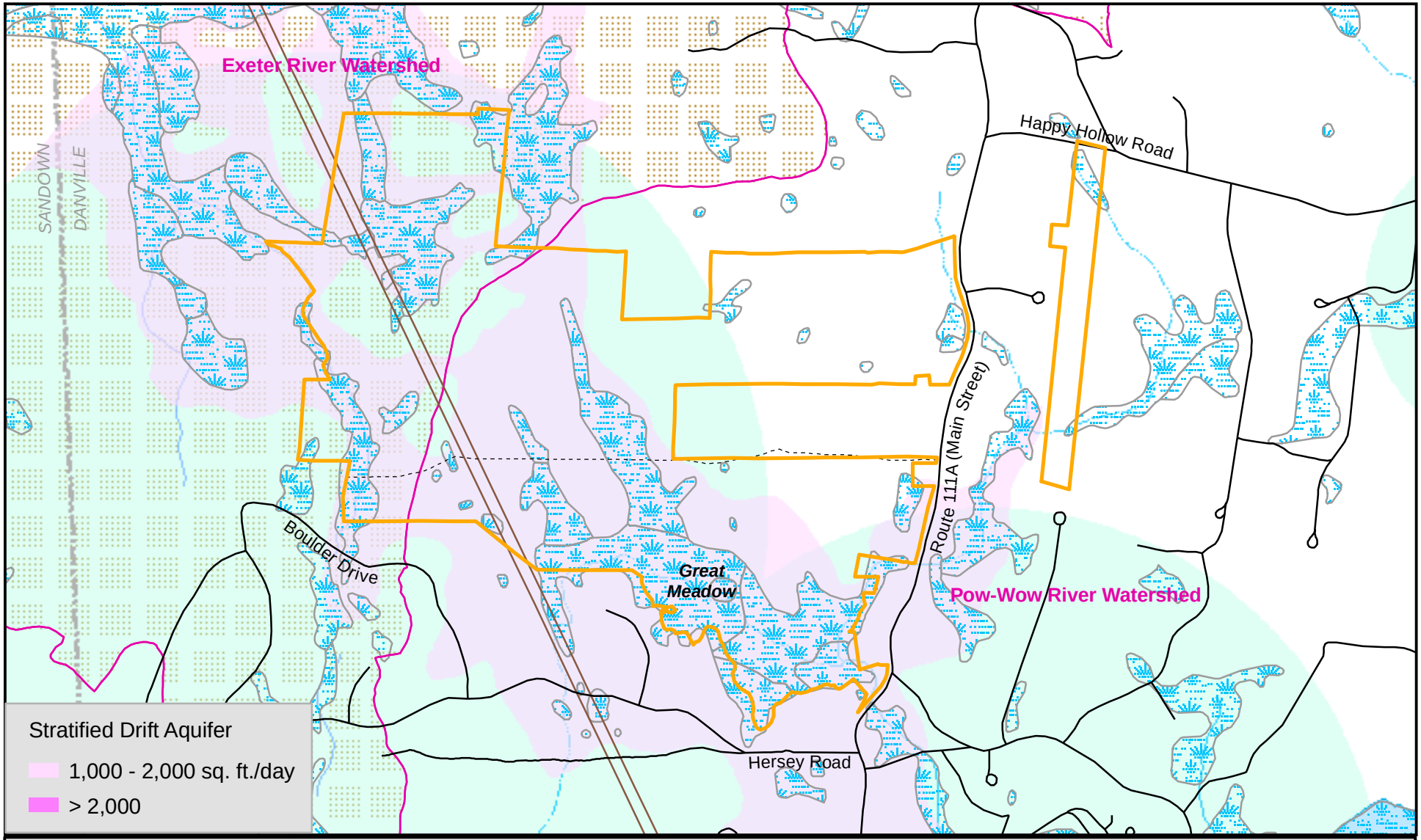
N

0 500 1,000 Feet

Map 5 Soils
Danville Town Forest
Danville, NH

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006. Water features from NH GRANIT. Wetlands from USFWS National Wetlands Inventory. Soils data from USDA 1:24,000 Soil Survey Geographic (SSURGO). Boundary & feature locations are approximate.

Map prepared by
Ibis Wildlife Consulting
September 2008



Danville Town Forest
Wetlands
River/Stream
Watershed Boundary
Town Boundary
Road
Powerline Corridor
Source Water Protection Area
Wellhead Protection Areas

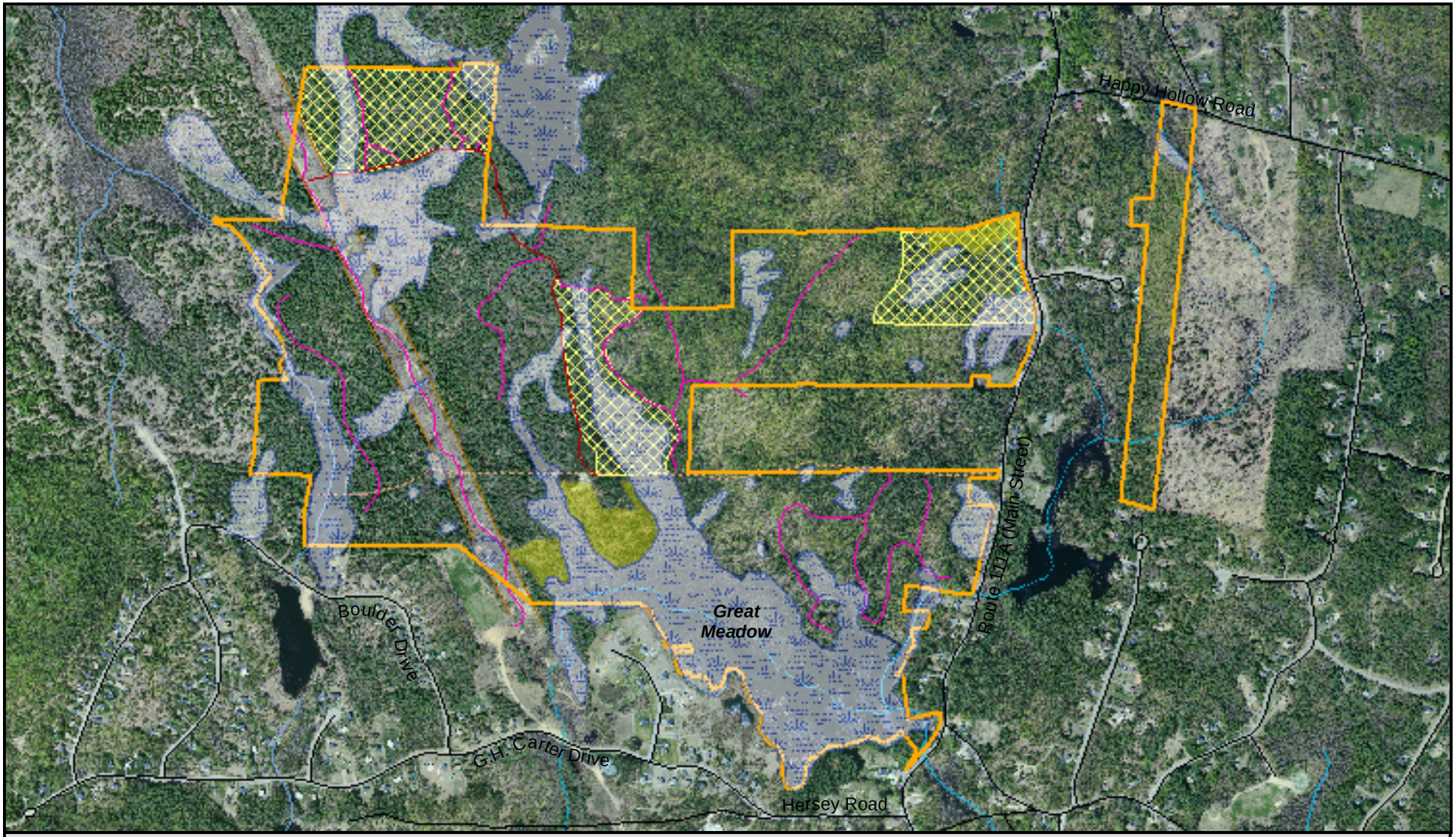
Map 6 Water Resources
Danville Town Forest
Danville, NH

0 1,000 2,000 Feet

N

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006.
Water resource features from NH GRANIT.
Wetlands from USFWS National Wetlands Inventory.
Boundary & feature locations are approximate.

Map prepared by
Ibis Wildlife Consulting
September 2008



Map 7
Recommended Natural Areas and Early Successional Habitats
Danville Town Forest
Danville, NH

- Danville Town Forest
- Wetlands
- Young Forest
- Powerline/Early Successional Habitat
- Proposed Natural Areas
- Tuckertown Road
- Woods Road/Trail
- Footpaths/Trails
- River/Stream
- Road

N

0 1,000 2,000 Feet

Property boundary based on survey by Doucet Survey, Inc. dated March 12, 2006.
Water resource features from NH GRANIT.
Wetlands from USFWS National Wetlands Inventory.
Boundary & feature locations are approximate.

Map prepared by
Ibis Wildlife Consulting
September 2008

Appendices

Appendix A	Proposed Conservation Easement Deed for Danville Town Forest
Appendix B	Plan of Land, Danville Town Forest, March 2006, Doucet Survey, Inc.
Appendix C	Danville Historic District Overlay and Historic District Ordinance
Appendix D	Plants and Animals Documented on the Danville Town Forest
Appendix E	Definitions of Class A Trail and Scenic Road
Appendix F	Maps from Forest Management Plan (Moreno 2002)

The on-line version of the report maintained by the NHEP does not include the six appendices. For electronic copies of the appendices, contact the NHEP office at 603-862-3403.